THE EFFECTS OF VISUAL AND AUDITORY CHARACTERISTICS OF WORDS ON PICTURE TO WORD MATCHING WITH LEARNING DISABLED CHILDREN

By

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By

Lynn Erb

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This study was conducted to determine the effects of three types of stimulus characteristics of words on the picture to word matching performance of learning disabled children. The three stimulus characteristics include (a) visually similar characteristics, (b) visually and auditorally similar characteristics, and (c) visually and auditorally dissimilar characteristics. Three identical treatment procedures were developed based on the three different types of stimulus characteristics.

The subjects participating in this study were six second grade children who were classified as learning disabled by the Florida criteria for a specific learning disability. The stimulus treatments were administered to the subjects individually by three different teachers, from three different schools. Each teacher administered treatment to two subjects. Each of these two subjects received treatment according to a different schedule. There were three design schedules and two subjects per design.

The stimulus treatments were administered in five phases. During Phase I, each subject received treatment for only one stimulus condition. During Phase II, each subject received treatment for two stimulus conditions. All three stimulus treatments were administered during Phase III. The first treatment to be administered was withdrawn during Phase IV. The second treatment to be administered was withdrawn during Phase V.

Data were collected every day from three one minute timings, one timing for each stimulus condition. Each timing consisted of matching 20 pictures (four of each picture) to 20 words (four of each word).

The results indicated that the visually and auditorally dissimilar word characteristics produced the greatest increase in the picture to word matching performance. The visually similar characteristics produced the least increase. There were more generalization effects from the visually similar treatments and the visually and auditorally similar treatments to the visually and auditorally dissimilar words than to any other words. Neither the teacher nor any particular design schedule influenced the experimental outcome significantly. The teachers administered the experimental treatments correctly and identically and responded to each subject in approximately the same manner as determined by the observations of two raters. The experimental words were equated semantically and were

of approximately the same level of difficulty. This strongly suggests that the factor producing the superior performance with the visually and auditorally dissimilar words was their stimulus characteristics.

CHAPTER I

INTRODUCTION

There is a large volume of literature encompassing the fields of education, psychology, neuroscience, and medicine related to the problem of reading failure. Data have been collected on numerous types of reading problems which have been manifested by children from all categories of exceptionality. Yet, children with reading problems diagnosed as specific learning disabled (SLD) present a particularly perplexing problem in acquiring reading skills. Many are otherwise bright and can perform other tasks at an advanced rate. For many years, this population of children was diagnosed as manifesting "minimal brain dysfunction." This term implied that the apparent cause of the reading failure was due to improper brain function. Some SLD children do exhibit signs of Central Nervous System (CNS) dysfunction but this is clearly not the case with many others (Hallahan & Kauffman, 1978). In addition, some SLD children have been reported to manifest auditory attention problems (Baker & Maddell, 1965; Conners, Kramer, & Guerra, 1969; Lasky & Tobin, 1973) and visual attention problems (Atkinson & Seunath, 1973; Elkind, Larson, & VanDoorminck, 1965; Hallahan, Kauffman, & Ball, 1973; Mondani & Tutko, 1969, Sabatino & Ysseldyke, 1972; Tarver, Hallahan, Kauffman, & Ball, 1976). By using instructional materials which take into account the possibility of a visual or auditory attention problem, it may be found that the reading problems manifested by some SLD children are due to the stimulus characteristics of the material.

Statement of the Problem

One reading approach is used to investigate the effects of three different stimulus characteristics of words on picture to word matching. The three different stimulus characteristics include visually similar characteristics, visually and auditorally similar characteristics,and visually and auditorally dissimilar characteristics. Three research questions are posed to determine which of these stimulus conditions are the most facilitating to the learner in performing a task of matching pictures to words. The research questions are (a) Which stimulus condition will cause the greatest increase in picture to word matching? (b) Which stimulus condition requires the least amount of time to reach proficiency (e.g., which stimulus condition is the most efficient in terms of teaching time)? and (c) Does instruction using one set of stimulus conditions influence the child's performance on words used in the other stimulus conditions (e.g., do the treatments generalize)?

Rationale

It has been reported that a high rate of substitution error occurs when subjects are asked to read and comprehend auditorally similar words (Neisser, 1967; Wicklegren, 1965a, 1965b, 1966). This behavior is observed most frequently in children who are just learning to read (Gibson & Levine, 1975); however mature readers process words with high acoustic similarity significantly slower than they do words with low or no acoustic similarity (Marcer, 1975). This phenomenon has been attributed to the loss of crucial discrimination cues that results when the visual letters are recoded into auditory representations which are subsequently confused with one another (Conrad, 1962, 1964; Conrad, Baddeley, & Hull, 1966).

In spite of the evidence supporting the existence of the acoustic similarity effect, it is interesting to note that one of the most commonly practiced reading methods with children uses acoustically similar words (i.e., the linguistic or word family approach). Research evidence would seem to suggest that this reading approach may not be appropriate for some children.

For the past 80 years, investigators have reported that visual-spatial difficulties are also a basic cause of reading disability (Bender, 1957; Harris, 1957; Hinshelwood, 1917; Johnson & Myklebust, 1967; Kephart, 1971; Money, 1962; Morgan, 1896; Orton, 1925, 1937; Stanley & Hall, 1973). More specifically, children with a reading disability process words containing similar or redundant visual elements as discrete entities thereby increasing the probability of discrimination error (Vellutino, Pruzek, Steger, & Meshoulam, 1973; Vellutino, Harding, Phillips, & Steger, 1975; Vellutino, Steger, DeSetto, & Phillips, 1975; Vellutino, Steger, Kaman, & DeSetto, 1975). Thus, the research from this group of investigators would not support a beginning reading method which presents stimuli requiring fine visual discriminations.

Because of the large volume of literature supporting the notion that a reading disability is a discrimination problem, it would seem logical to teach poor readers in a manner which considers discrimination learning. This type of learning is facilitated by emphasizing the distinctive features to be used in making the discrimination and by initially providing examples showing marked contrasts. What is learned in discrimination learning are the distinctive features of the stimuli (Gibson, 1969; Gibson & Gibson, 1955; Travers, 1972). Words contain many kinds of information and are learned as a complex of features (Gibson, 1965, 1971). Thus, it would seem that an appropriate way to teach children to read would be to use highly dissimilar words having many distinctive features. This type of reading approach is similar to the non-linguistic basals or sight word method of reading.

The work of Becker, Engelmann, and Thomas (1971) lends further support to the notion of providing initial stimuli which contain many contrasting features. These investigators have shown that most errors in concept formation occur when children respond to instances of one concept as if they were instances of another (stimulus generalization). Thus stimulus generalization, by children, occurs quite frequently when two concepts have many common characteristics and few differences. It was further suggested by these researchers that the appropriate teaching strategy for concept formation is to stress the differences between concepts, not the similarities. This research seems to suggest that teaching words with many similarities would be an inefficient way to initially approach the reading process as much time would be needed to point out the distinctive features of each individual word.

In a similar study (Erb, Algozzine, & Mercer, 1978), which utilized the same visual and auditory stimulus characteristics, it was found that SLD children learned to recognize visually and auditorally dissimilar words six times faster than they did visually similar words and three times faster than they did visually and auditorally similar words. All of the children in the study performed significantly better with the visually and auditorally dissimilar words. The present study is designed to control more variables than this previous study (treatment interaction, investigator bias, generalization of treatment effects) and to support earlier findings through replication.

Definition of Terms

Learning Disabled: For purposes of this study a learning disability is defined by the Florida criteria for a specific learning disability (see Appendix A).

Proficiency: In this study, proficiency is established at a rate of 20 correct picture to word matches with no errors in one minute.

Resource room: A resource room refers to a classroom to which small groups of students are assigned for some portion of the school day to receive specialized academic instruction.

Visually and auditorally dissimilar: Visually and auditorally dissimilar refers to a set of words which exhibit different visual configurations, different initial and final sounds and the number of letters among words in a set may vary.

Visually and auditorally similar: Visually and auditorally similar refers to a set of rhyming words. The words in a set may have different initial sounds but the final three sounds are the same.

Visually similar: Visually similar refers to a set of words which have the same number of letters, the same visual configuration, and the first two letters of each word are the same.

Limitations

It was not possible to control for learning outside of the experimental situation. All of the subjects attended a regular class after they left the resource room where the experimental treatment was administered. Though the experiment lasted only 25 school days, it was possible, but highly unlikely, that some children were exposed to several of the words used in this study and thus received extra practice with some of the words. Because all but seven of the words are pictured as commonly used, simple nouns, each word had about the same chance of being exposed.

Delimitations

This study was limited to young SLD children identified by the Florida criteria for specific learning disabled. The six children were selected from the population of second grade children attending an SLD resource room in the public schools of Gainesville, Florida.

The stimulus words used in this study are limited by their visual and auditory characteristics. Though the results may indicate that certain stimulus characteristics of words are more facilitating to the reading process, the findings may not be specifically generalized to commercial reading programs. These programs differ along several dimensions, such as the stimulus characteristics of the words used, the interest level of the material, the repetition of words used throughout the program, and the format of material presentation. This study was designed to investigate only one of these dimensions, the visual and auditory characteristics of words and their effect on a picture to word matching task.

CHAPTER II

LITERATURE REVIEW

For many years, investigators from all phases of educational research have been concerned with the problem of reading failure. A comprehensive review of the literature provides only a few studies which focus directly on the stimulus characteristics of words in relation to learning. Since learning to read is such a complex process, involving the acquisition of a variety of skills, the majority of the investigations in this area have studied children's strengths and weaknesses in specific skill areas. Little attention has been devoted to the impact of the stimulus characteristics of the reading material on learning. The scant amount of literature in this latter area deals primarily with the effects of two different types of phonetic word lists, minimal contrast and maximal contrast, on the reading process. A minimal contrast word list is composed of words which are alike except for one element, such as men, ten, pen (Hartley, 1970). In this list the final two elements (en) of the words are held constant while the first element varies. A maximal contrast list is one in which no elements within the word are held constant, such as rake, flower, snow (Hartley, 1970).

Different reading programs have been developed which utilize the principles from the maximal and minimal contrast word lists, but there are very few empirical studies which have investigated the effects of the redundancy or distinctiveness of visual and acoustic cues on the acquisition of words. Research has been performed with mentally retarded subjects in relation to their attention to relevant cues on discrimination learning tasks (Fisher & Zeaman, 1973; Ullman & Routh, 1971). However, this research does not focus on the impact of the stimulus material on the learning of words. It has been shown that many SLD children have auditory discrimination problems and confuse phonemes which differ by only one distinctive feature (Wiig & Semel, 1976). Thus, the stimulus characteristics of the reading material may be a significant factor in determining whether or not the SLD child experiences success with the reading process.

Theories of mediated word identification proposed by Gibson (1965) and Smith (1971) support a distinctive feature word analysis model which suggests that the initial reading material should contain words with marked contrasts. According to this type of model, children first attend to and store the features of words, not whole words. These features are then compared and contrasted with new words. Thus, the initial presentation of highly dissimilar words should facilitate the reading process.

The following sections will present a more indepth discussion of the research regarding the characteristics of stimulus material on learning. Little research has been devoted to this topic, yet it has very direct and relevant implications for the reading process and could have a particular impact on children with specific types of learning problems.

Minimal Contrast Word Lists

Several commercially available and widely used beginning reading programs employ the use of minimal contrast word lists. These programs include the Let's Read series, Merrill Linguistic Readers, Sullivan Programmed Readers, Palo Alto, Open Court, and Miami Linguistic Readers. The emphasis of these programs is to teach a lot of words rapidly by focusing on the regularities of the language. The programs are based on the principle of minimal variation and stress the whole word approach.

Linguistic Theories

Support for the use of the minimal contrast list approach comes from such linguists as Fries, Bloomfield, and Soffietti. Fries (1962) has suggested that initial reading vocabulary acquisition should begin with short words containing graphemes (letters) with one phonetic value. These words would conform to the regularities exemplified by the minimal contrast word list and would be programmed for the student in a step-by-step progression through the basic regularities of the language. The student would be exposed to the irregularities only after having developed competence with the regularities.

Bloomfield and Barnhart (1961) also recommend that initial reading instruction begin by teaching words exemplifying the regularities of the language. They would accomplish this by first introducing the child to monosyllabic words having a regular grapheme to phoneme correspondence. An earlier proponent of this approach to reading, Soffietti (1955), has asserted that a child could not readily learn word identification if forced to deal initially with the phonetic inconsistencies of the language.

Word List Studies

The basic empirical support for this type of reading approach comes from the studies performed by Levin and Watson (1961a, 1961b). These investigators found that students learn a constant or patterned word list significantly faster than a nonpatterned or variable list. Levin, Baum, and Bostwick (1963) reported that a constant list facilitates transfer learning faster than a variable list. All three of these studies used either English or Spanish speaking college students and the task involved memorizing lists of words, not learning to read. In a similar type of experiment, Gagne (1950) found that when subjects were given lists to memorize, they performed better on those lists emphasizing intra-list similarity (minimal contrasts). Again the population was older, and the experiment was designed to investigate the effects of word similarity on the memory process. This study also used nonsense words which severely limits generalization to reading tasks.

One study which is often used to support the minimal contrast reading approach was performed by Rotberg and Woolman (1963). These investigators found that memorizing a list of words was more effective when the lists were composed of similar items. It was then proposed that stimulus similarity decreases discrimination difficulty while increasing the opportunity for "coding." This latter point may be true for the memorization of word lists, but to use this study or any of the preceding studies as empirical evidence that minimal contrast word lists facilitate the reading process is unwarranted.

Maximal Contrast Word Lists

Maximal contrast reading approaches have been used in the public schools since the first readers were printed. This type of approach would use a sight word basal series such as The Bank Street Readers, City Schools Readers, and Multi-Media Chandler Reading Program. Critics have scoffed at many of the specific features of sight word basal readers such as the language and phonics presentation. But, in spite of severe criticism, the sight word basal reader has been widely accepted in the regular classroom. Teachers seem to have found that it is successful in teaching children to read, though investigators have attempted to show that traditional methods of reading are not adequate (Lerner, 1976).

The only experimental research support for the use of maximal contrast word lists also comes from psychological research. It was reported by Rothkopf (1958) that lists which have maximal differences among the items in paired-associate learning are more rapidly learned than lists with small or minimal differences among the items in the list. In a series of studies conducted by Underwood (1952, 1953a, 1953b, 1953c) it was found that the higher the intra-list similarity (minimal contrast) the more difficult the learning and the relearning. An analysis of the confusion errors on Levin and Watson's (1961a) word lists indicated that words which share an initial grapheme and phoneme are most confused with each other, those which share terminal elements are next, and words with no common elements are the least confused. As was true of the minimal contrast investigations, these studies all used older subjects and memory tasks, thus their generalizability to the present problem is limited. Besides the lack of generalizability, the studies are conflicting and confusing to the point that one study, Levin and Watson (1961a), is used in the literature to support both arguments.

Comparisons Between Maximal Contrast Reading Approaches and Minimal Contrast Reading Approaches

Several studies in the late 1950s and 1960s have compared the effects of a maximal contrast (sight word basal) reading approach to a minimal contrast (linguistic reader) reading approach. The results of these studies have either produced relatively insignificant results or the significant effects were "washed out" by the end of the third grade.

MacKinnon (1959) compared the beginning reading performance of two groups of kindergarten children. The first group of children practiced reading with a sight word basal reader while the other group practiced with the same sight word basal plus a linguistic reader. The basal plus linguistic method produced superior word recognition skills. Chall (1967) reports that these results cannot be considered conclusive for two reasons. First, the children reading the basal plus linguistic readers were taken from their regular class to receive treatment with the linguistic approach and this novelty effect could have produced the significant results. Second, these children were also given "fresh" materials to read, while the children using the basal reader had to continue practicing with the same materials.

Ruddell (1966, 1967) compared the effects of four different reading approaches on the performance of beginning readers. The four approaches included a sight word basal, a basal plus language structure, a programmed linguistic series, and a programmed linguistic series plus language structure. At the completion of the second grade, there were few differences among the four methods. The reported differences showed that the language structure facilitated learning in the linguistic approach but not the basal approach and that the linguistic programs were more facilitating to word recognition skills, but not to a significant degree.

A sight word basal approach and a linguistic program plus dialect training approach were compared by Rystrom (1970). Neither approach was superior to the other in teaching beginning reading to four classes of rural black children.

Schneyer (1969) compared a sight word basal approach to a linguistic approach and reported several differences between the two groups. He found that the basal reader produced better performances on such skills as paragraph meaning, spelling, phonics, and rate and accuracy of oral reading. The basal also produced superior results in comprehension, for average students and superior results in phonics skills for high ability students. The linguistic group exhibited better writing skills, yet this effect was "washed out" at the completion of the second grade. At the end of the third grade, the only difference between the two groups was that the basal group was superior in phonics skills.

Sheldon, Stinson, and Peebles (1969) also reported the results of a three year study comparing a sight word basal approach to a modified linguistic approach. At the termination of the third grade there were no differences in any reading skills between the two approaches. These investigators also reported that there were some students in each reading group who were disabled readers and that neither approach was more effective in eliminating this problem.

Bond and Dykstra (1967) compared a sight word basal approach to a linguistic approach as one of five beginning reading approach comparisons. These investigators reported that the most common finding of this comparison was that of no differences between the two groups. The linguistic group tended to perform better on tests of word recognition while the basal group exhibited better performances in oral reading speed and accuracy.

The results of all of these studies appear to be inconclusive or insignificant. Though the studies are several years old, new data have not been generated to substantiate or refute any of the previous findings. Many of the studies could be criticized for such things as the methodology employed or the equivalency of experimental groups. These criticisms would probably render all of the results inconclusive. Yet, comparisons of one total reading program to another total reading program do not appear to be the best way to solve the issue of maximal contrast approach versus minimal contrast approach. Even though the reading programs were measured for effects on such skills as word recognition or comprehension, there are many factors, such as stimulus characteristics of the words, level of syntax or interest level of the material, which could have attributed to the superiority of one approach in teaching a certain skill. Further research efforts should define the dimensions by which the two approaches differ and systematically investigate the contrasting factors.

Discrimination Problems of Learning Disabled Children

Wiig and Semel (1976) have reported that many learning disabled children exhibit auditory discrimination problems which limit their ability to differentiate between phonemes which have only one contrasting, phonological feature. For example, SLD children frequently confuse the word pairs, drain and train, or pat and bat. Since reading is usually taught as an auditory-visual process, requiring children with limited discrimination abilities to perform fine differentiation tasks both auditorally and visually could result in many unsuccessful experiences in learning to read. One of the most commonly practiced teaching methods with SLD children utilizes stimulus words with few distinguishing features. There is no empirical basis for using this approach with SLD children and it may not be the appropriate method to employ with some children in initial reading acquisition tasks.

Theories of Mediated Word Identification

Several theories of mediated word identification have been proposed in the literature. However, the theories of Gibson (1965) and Smith (1971) are the most pertinent to the stimulus characteristics issue.

Gibson's Theory

Gibson's (1965) model is based on the premise that differentiating graphic symbols from one another is viewed as a logically preliminary stage to decoding them into speech. The original basis for this differentiation is detecting the distinctive features of letters. Once the set of features for each letter is established, prototypes, e.g. grapheme configuration, for these letter shapes may be learned. The next phase in the Gibson model proposes that letter-sound relationships are learned in such a way that a "set for diversity" is established from the beginning. This "set" will facilitate the learning of new letter-sound correspondences which contain variable relationships. In other words, the distinctive feature concept is basic to the acquisition of reading according to the Gibson model. Children need contrasting stimuli in order to facilitate their initial word discriminations.

Smith's Theory

The theory of word identification proposed by Smith (1971) stresses the distinctive feature concept even more. Smith suggests that the reader learns the process of feature discrimination and thus tags visual features as fitting certain acoustic, semantic categories. Thus, first words are learned as wholes and are stored as sets of features with visual, acoustic and semantic properties. As soon as the beginning reader has a store of these immediately identifiable words, he uses these feature sets to analyze unfamiliar words. He compares and contrasts the unknown to the known and combines sets of features to form new sets of features. This entire model is based on the process of feature identification and contrast.

Though the Smith model places the greatest emphasis on this concept, both Gibson and Smith contend that sets of features, rather than individual words and parts are stored and that feature tests are conducted on new words.

Summary

At the present time little research has been reported pertaining to the visual and auditory stimulus characteristics of words and their impact on word recognition. Support for both minimal contrast words and maximal contrast words, comes from the results of psychological research conducted with subjects who were mature readers. This situation, coupled with the fact that the research was investigating a memory task, does not permit direct generalization to reading acquisition. Thus, no conclusions can be drawn from these studies for formulating a hypothesis about which type of word list is more facilitating to the reading process.

Additionally, the research effort concerned with the reading acquisition characteristics of certain handicapped subgroups of the population has been primarily directed at the discrimination learning ability of mentally retarded learners. These studies did not measure reading acquisition specifically but did report that the mentally retarded child learns better when the stimuli presented are contrasting in nature and differences among the stimulus items are readily apparent. Children with specific learning disabilities may also require initial reading stimuli which require broad rather than fine discriminations, as many of these children are known to have limited auditory discrimination abilities.

The two word identification models presented in this review also stress the use of contrasts and distinctions in the initial stages of reading. It was suggested by both Smith (1971) and Gibson (1965) that the beginning reader needs to make feature identifications and discriminations in order to learn to read. This process is facilitated by the presentation of stimulus material which contain features which are easily differentiated. It is to this point that the present research is focused. More specifically the purpose of this investigation is to determine what impact the stimulus characteristics of words (redundancy or distinctiveness of visual and auditory cues) will have on the picture to word matching ability of six SLD children. Previous studies of this type have attempted to compare total reading programs which emphasize different features of words, the maximal contrast or sight word basal approach versus the minimal contrast or linguistic approach. The results of these studies were either insignificant or inconclusive. Because so many factors were involved in producing the results, a systematic analysis of each of these factors is warranted. This study attempts to directly measure only one of the dimensions by which the maximal contrast reading approach differs from the minimal contrast reading approach, i.e., the stimulus characteristics of the words presented in each approach. This direct measurement procedure should determine what effects these stimulus characteristics have on a picture to word matching task in terms of learner acquisition rate, teaching efficiency, and stimulus generalization.

CHAPTER III

METHOD

This chapter presents a description of the experimental procedures used to determine the effects of three different stimulus characteristics of words on picture to word matching tasks. The three stimulus conditions include visually similar words, visually and auditorally similar words, and visually and auditorally dissimilar words. The experimental treatment was administered in five phases and allowed for daily measures of the stimulus generalization effects of each stimulus condition. The acquisition rate of words for each stimulus condition was assessed as well as the number of days required to learn words belonging to a particular stimulus condition.

Subjects

Second grade children, attending five different public school SLD resource rooms in Gainesville, Florida, were initially screened for participation in the study. These children were administered a word recognition pretest which consisted of all the experimental words (see Appendix B for a list of the experimental words) and a picture recognition pretest, which consisted of pictures of all the experimental words. The word recognition pretest was administered to each child on two different testing occasions, two days apart. The child had to obtain a score of zero on both of these pretest trials in order to be considered for participation in this study. In addition, each child had to obtain a score of 75 percent in each of the three picture recognition categories. These categories included (a) pictures of the visually similar experimental words, (b) pictures of the visually and auditorally similar experimental words, and (c) pictures of the visually and auditorally dissimilar experimental words. The subjects meeting these criteria were from three different schools. The other two schools did not have any second grade children who met the word recognition pretest criterion. The first two children from each of the three schools, who met the pretest criteria, were selected as subjects for this study. Demographic data for the six subjects selected are presented in Table 1.

Table 1

Demographic Data for Subjects

Subject	Age	Race	Sex	IQ
1	8-3	White	Male	125
2	8-9	Black	Female	95
3	8-2	Black	Female	106
4	8-6	White	Male	100
5	8-6	Black	Male	98
6	8-10	White	Male	93

Experimental Design

This design measures the experimental effects of three treatments, on one behavior, across six subjects, in similar settings. The same behavior (picture to word matching) was treated with three different stimulus conditions: visually similar words, visually and auditorally similar words, and visually and auditorally dissimilar words. The effects of these three stimulus conditions on picture to word matching were measured daily for each of the six subjects by three one minute time samples, one time sample for each of the stimulus conditions. The design controls for stimulus generalization of the three treatment effects. The experimental design is presented in Tables 2 through 4.

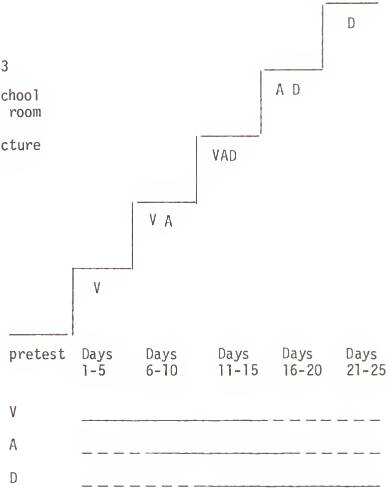
Table 2

Treatment Schedule for Subjects S_1 and S_3

Subjects: S_1 and S_3

Setting: Public school resource room

Behavior: Match picture to word



Key:

_ _ _ data collected without treatment in effect
——— data collected with treatment in effect
V denotes visually similar
A denotes visually and auditorally similar
D denotes visually and auditorally dissimilar

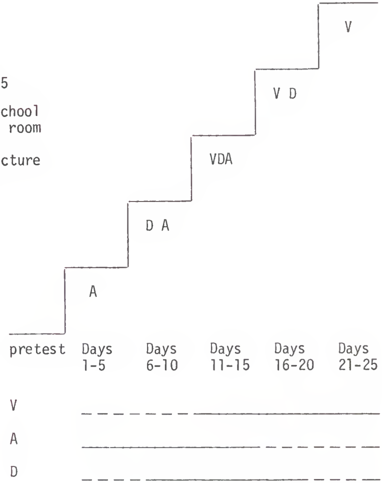
Table 3

Treatment Schedule for Subjects S_2 and S_5

Subjects: S_2 and S_5

Setting: Public school resource room

Behavior: Match picture to word



Key:

_ _ _ data collected without treatment in effect
——— data collected with treatment in effect
V denotes visually similar
A denotes visually and auditorally similar
D denotes visually and auditorally dissimilar

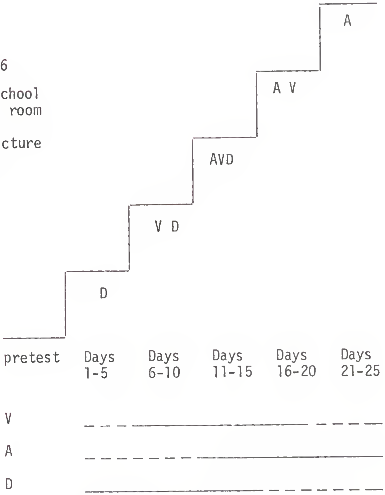
Table 4

Treatment Schedule for Subjects S_4 and S_6

Subjects: S_4 and S_6

Setting: Public school resource room

Behavior: Match picture to word



Key:

_ _ _	data collected without treatment in effect
———	data collected with treatment in effect
V	denotes visually similar
A	denotes visually and auditorally similar
D	denotes visually and auditorally dissimilar

Treatment Phases

The schedule of treatments was presented in five phases each of which was five days long. An explanation of these phases is presented below. (For descriptive purposes, the following abbreviations are used to denote the three stimulus conditions: V denotes visually similar, A denotes visually and auditorally similar, and D denotes visually and auditorally dissimilar.) Subjects S1 and S2 received treatment from Teacher 1, Subjects S3 and S4 from Teacher 2, and Subjects S5 and S6 from Teacher 3.

Phase I -- This phase consisted of a single stimulus condition interval such that the entire treatment session lasted only 15 minutes. Each subject (S1, S2, S3, S4, S5, and S6) received treatment according to his appropriate schedule.

Subjects	S1	S2	S3	S4	S5	S6
Treatments	V	A	V	D	A	D

Phase II -- This phase consisted of the treatment interval administered in Phase I with an additional treatment interval. The treatment session lasted 30 minutes and the subject received treatment for two stimulus conditions. The treatments were administered in a different order each day.

Subjects	S1	S2	S3	S4	S5	S6
Treatments	V	A	V	D	A	D
	A	D	A	V	D	V

Phase III -- Each subject received treatment for all three stimulus conditions during this phase. The entire treatment session lasted 45 minutes. The treatments were administered in a different order for each of the five days of this phase. (See Appendix D for exact treatment orders.)

Subjects	S1	S2	S3	S4	S5	S6
Treatments	V	A	V	D	A	D
	A	D	A	V	D	V
	D	V	D	A	V	A

Phase IV -- During this phase, the first treatment interval to be administered was withdrawn, so that each child received treatment for only two of the three stimulus conditions. The order of treatment presentation was altered each day and this treatment session lasted for 30 minutes.

Subjects	S1	S2	S3	S4	S5	S6
Treatments	A	D	A	V	D	V
	D	V	D	A	V	A

Phase V -- The second treatment interval to be introduced was withdrawn during this phase so that each subject received treatment for only one of the three stimulus conditions. This treatment session lasted only 15 minutes.

Subjects	S1	S2	S3	S4	S5	S6
Treatments	D	V	D	A	V	D

Tasks and Materials

The materials for each set of words were identical except for the words and pictures used. These materials consisted of pictures, word sets, worksheets, word sorting cards, Link Letters with picture-word cards, and Standard Behavior Charts.

Pictures. The pictures used in the study were taken from various children's books. All the pictures were photocopies and were approximately the same size.

Word Sets. All the words used in the study were taken from The Teacher's Word Book of 30,000 Words (Thorndike & Lorge, 1972). The subjects were not able to read any of the words used in the study at the beginning of the experiment as determined by a pretest.

The majority of the experimental words were pictured as simple nouns. Seven words were pictured as verbs (boil, swim, break, sing, eat, run, and bake). Thus, the semantic referent is given for each of the words, controlling for word meaning. A semantic feature analysis of the experimental words is presented in Tables 5, 6, and 7. The words were classified according to four semantic features: (a) concrete, (b) animate, (c) common, and (d) human. A plus (+) is indicated if a particular feature is characteristic of a particular word. A minus (-) is indicated if a particular feature is not characteristic of a particular word. Visual inspection of each table reveals few semantic feature differences among the words belonging to each stimulus condition. The majority of the words, approximately 88 percent for each condition, were common, concrete nouns.

Table 5

Semantic Feature Analysis of Visually Similar Words

	concrete	animate	common	human
boil	-	-	-	-
bowl	+	-	+	-
boot	+	-	+	-
boat	+	-	+	-
book	+	-	+	-
foil	+	-	+	-
fort	+	-	+	-
foot	+	-	+	+
food	+	-	+	-
fork	+	-	+	-
brick	+	-	+	-
bread	+	-	+	-
break	-	-	-	-
braid	+	-	+	-
brush	+	-	+	-

Table 6

Semantic Feature Analysis of
Visually and Auditorally Similar Words

	concrete	animate	common	human
snake	+	+	+	-
lake	+	-	+	-
bake	-	-	-	-
rake	+	-	+	-
cake	+	-	+	-
state	-	-	+	-
skate	+	-	+	-
gate	+	-	+	-
date	-	-	+	-
plate	+	-	+	-
snail	+	+	+	-
nail	+	-	+	-
tail	+	-	+	-
pail	+	-	+	-
sail	+	-	+	-
chair	+	-	+	-
hair	+	-	+	-
pair	-	-	+	-
fair	+	-	+	-
stair	+	-	+	-
frown	-	-	+	-
clown	+	-	+	+
gown	+	-	+	-
crown	+	-	+	-
town	+	-	+	-
sock	+	-	+	-
rock	+	-	+	-
clock	+	-	+	-
block	+	-	+	-
lock	+	-	+	-

Table 7

Semantic Feature Analysis of Visually and Auditorally Dissimilar Words

	concrete	animate	common	human
flower	+	-	+	-
grape	+	-	+	-
web	+	-	+	-
lion	+	+	+	-
sing	-	-	-	-
wagon	+	-	+	-
tiger	+	+	+	-
rug	+	-	+	-
corn	+	-	+	-
leg	+	-	+	+
chicken	+	+	+	-
train	+	-	+	-
baby	+	+	+	+
girl	+	+	+	+
truck	+	-	+	-
vase	+	-	+	-
mask	+	-	+	-
plant	+	-	+	-
table	+	-	+	-
elephant	+	+	+	-
apple	+	-	+	-
horse	+	+	+	-
tent	+	-	+	-
milk	+	-	+	-
bed	+	-	+	-
spoon	+	-	+	-
table	+	-	+	-
flag	+	-	+	-
witch	+	+	+	+
glass	+	-	+	-
door	+	-	+	-
house	+	-	+	-
ring	+	-	+	-
pipe	+	-	+	-
fish	+	+	+	-

Thus, the semantic features of the experimental words are fairly equivalent. Through the sequential instructional method provided by the experimental treatment, the child should learn the appropriate picture to word association.

The words used in the study were divided into three groups: (a) visually similar, (b) visually and auditorally similar, and (c) visually and auditorally dissimilar. These groups provided the basis for developing the three different stimulus conditions. All the word members of each group have certain characteristics in common, i.e., visually similar, visually and auditorally similar, and visually and auditorally dissimilar. Each word was used in one group only and would not fit the characteristics of the other groups, thus the words in each group are mutually exclusive. For each group there were several word sets consisting of five words per set.

The visually similar words in a set had the same number of letters, the same visual configuration and the first two letters of each word were the same.

Word Sets Used: Visually Similar Words

I.	II.	III.
boil	foil	brick
bowl	fort	bread
boot	foot	break
book	food	braid
boat	fork	brush

The visually and auditorally similar words have different initial sounds, but all the words in a set rhyme with each other. These words have different initial sounds and different numbers of letters.

Word Sets Used: Visually and Auditorally Similar Words

I.	II.	III.	IV.	V.	VI.
snake	state	snail	chair	gown	rock
lake	skate	nail	hair	clown	sock
cake	gate	tail	pair	town	clock
bake	date	pail	fair	frown	block
rake	plate	sail	stair	crown	lock

The visually similar words and the visually and auditorally similar words could also be categorized as minimal contrast words which vary along two different dimensions. The visually similar words display the minimal contrast characteristic because the configuration and the initial two letters of each word are the same. Thus, an important difference in word attack skills may be revealed by controlling for the position of the minimal contrast characteristic. Though the visually and auditorally similar words seem to be compounded by visual similarity as well as by auditory similarity, these words may actually be easier for some children to learn than the visually similar words. This phenomenon could occur if a child only pays attention to the initial cues provided by words and does not perceive the word as a whole. The child may memorize the word ending and need only look at the initial sound(s) in order to recognize the word. This particular strategy may work well for decoding words which belong to the visually and auditorally similar stimulus condition. This strategy will probably not be an effective technique for decoding words which are not phonetically regular, such as the visually similar words and the visually and auditorally dissimilar words.

The visually and auditorally dissimilar words differ on several dimensions. Their configurations are different, as well as their initial and final sounds. Also, the number of letters in each word may vary. These words could be categorized as maximal contrast words as all the words vary along different dimensions without holding constant any particular characteristics.

Word Sets Used: Visually and Auditorally Dissimilar Words

I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.
flower	wagon	corn	apple	table	glass	run	tree	watch
grape	truck	leg	girl	milk	witch	fish	eat	swim
lion	tiger	chicken	vase	bed	door	pipe	star	desk
sing	rug	train	mask	spoon	house	elephant	bike	cow
web	plant	baby	horse	flag	ring	tent	pencil	phone

Worksheets. For each set of words there are ten worksheets. All of the worksheets are identical in structure, differing only in the words and pictures used. The worksheets consist of ten carefully sequenced tasks which proceed in the following order:

(a) A picture of each word in the word set is presented with a corresponding dot-to-dot form of the word. The child's task is to connect the dots to see the word.

(b) A picture of each word in the word set is presented with three letters. The child's task is to circle the initial sound of the word pictured.

(c) A picture of each word in the word set is presented with the printed word, minus its initial sound. The child's task is to fill in the blank with the correct letter.

(d) A picture of each word in the word set is presented with one other irrelevant picture and a printed model of the word. The child's task is to circle the correct picture.

(e) A picture of each word in the word set is presented with five printed words. The child's task is to match the correct picture to the correct word.

(f) Each word in the word set is presented in printed form on one side of the page and the same five words are listed in a different order on the other side of the page. The child's task is to match the identical words.

(g) The configurational outline of each word in the word set is presented with spaces marked off for the number of letters in each word. The child's task is to fill in the configurations with the correct word.

(h) A picture of each word in the word set is presented with blanks marked off for the number of letters in the corresponding word. The child's task is to fill in the blanks with the correct word. The five words are listed at the bottom of the page.

(i) The words are presented in scrambled form. The child's task is to unscramble the words. The correct words are listed at the bottom of the page.

(j) Five words that rhyme with each of the five words in the word set are presented. The child's task is to fill in the blanks with the correct word. The five correct words are listed at the bottom of the page. (See Appendix D for examples of the worksheets.)

Word Sorting Cards. There are 50 word sorting cards for each set of words, ten cards for each of the five words. The child's task is to put all the words that are alike into one group, so upon completion of the task he has five groups of words.

Link Letters and Picture-Word Cards. Link Letters, a set of cardboard letters manufactured by Milton Bradley Company, were used with five picture-word cards to form a spelling task. The cards have a word printed on one side and a picture of the word on the other side. The child's task is to first spell the word with the Link Letters by looking at the printed model of the word. After successful completion of this task, he will then turn the cards over to the picture side, take the Link Letters apart, mix them up, and spell the words with just the picture models.

Measurement

Three daily data charts were kept on each child; one chart for each stimulus condition. The pinpoint which was charted was "see word, match picture to word." Three one-minute timings were taken every day, one timing for each stimulus condition. The timings were taken at the beginning of each treatment session. The task for the timings consisted of matching 20 pictures (four of each picture) spread randomly on a desk top to 20 words (four of each word) which the child held in his hand. The pictures and words were different for each stimulus condition. Proficiency was 100 percent accuracy in one minute or less for one day's timing. In other words, the child had to match all 20 pictures to the corresponding words correctly by the end of one minute. After proficiency was reached on a set of words for a stimulus condition, the child was not timed on that particular set of words again. The next day he was timed three times as usual, but for the stimulus condition in which he had reached proficiency, he was timed on a new set of words. So, his timing for each set of words following the proficient set of words was always zero since treatment may have been administered the preceding day. (Data were collected each day regardless of whether the child was receiving treatment for a particular stimulus condition; mere exposure to the words through the daily timings or stimulus generalization from another treatment may have resulted in proficient learning without direct treatment.)

Specific Procedures

Treatment Sessions

The treatment was administered to each subject individually by one of three teaching assistants. Each teacher administered treatment to two subjects at different times during the school day. The treatment was administered in a public school resource room.

The experimental treatment was administered for 25 school days and was divided into five phases of five days duration. During each phase, the different stimulus conditions were presented either alone or with one or both of the other stimulus conditions. Each stimulus condition interval lasted 15 minutes, thus a treatment session may have endured from 15 to 45 minutes. There were three categories of treatment order. Two subjects, from different teachers, received treatment for each category. (There were three teachers, six subjects, and three treatment categories. Each teacher administered treatment to two subjects with different treatment orders. Thus, none of the teachers administered all three categories of treatment.)

Three data points were collected each day, one for each of the stimulus conditions, whether or not the subjects were receiving treatment for that particular stimulus condition. This procedure measured the effects of stimulus generalization from one stimulus condition to another.

A description of the treatment session is as follows:

(1) At the beginning of each treatment session the child took three one minute timings, one timing for each of the three stimulus conditions. The order of the timings was counterbalanced to ensure that the timing scores were not the result of presentation order.

(2) After completing the timings, the child went to his seat. The teacher gave him the appropriate treatment materials.

   (a) If the child had never received treatment for a particular set of words, then his first task was to complete a set of ten worksheets.

   (b) If the child had already completed the ten worksheets for a particular set of words, in a previous treatment session, then his first task was to complete the Link Letters spelling task.

(c) The word sorting task was always the last task the child completed during a treatment session.

(3) When a subject reached proficiency (determined by the timings) for a set of words within a particular stimulus condition, he received treatment with a new set of words for that particular stimulus condition. The subject would perform the same sequence of tasks he performed with the previous set of words (i.e., worksheets, Link Letters spelling task, and word sorting cards) until proficiency was reached.

(4) After treatment was withdrawn (after 15 days) for a particular stimulus condition, the child continued to take a daily timing on the particular set of words for which he was last receiving treatment but did not reach proficiency. He continued to be timed each day on that set of words (as well as the two sets of words from the other stimulus conditions) until he reached proficiency. At this time a new set of words for that stimulus condition was introduced through the daily timings even though treatment had been terminated.

(5) The treatment interval for each stimulus condition was 15 minutes long. The subject had to complete as many tasks as possible during that time. The number of treatment intervals varied from one to three depending on the particular phase of the experiment. Thus, the treatment session could have lasted from 15 to 45 minutes.

(6) At the end of each treatment session the subject was given a reinforcer of his choice, from a treasure chest which contained a variety of small toys, such as rings, marbles, firemen, stickers, jumping beans, etc.

Training Procedures for Teachers

Each of the three teaching assistants participated in two training sessions. During the first session, the materials and the experimental procedures were explained to the three trainees. The treatment materials were designed to be as free from teacher direction as possible thus the need for a lengthy teacher training procedure was unnecessary. The sequential progression of the tasks was designed to facilitate learner independence and eliminate much of the need for teacher guidance. When a child raised his hand to ask a question, the teacher was allowed to perform one of the following instructional procedures: (1) answer a question, (2) give a cue, or (3) model the answer. If the child continued to ask for help the teacher responded, "I have given you all the help I can. Please try it by yourself." If the child became frustrated or upset, the teacher performed one of the instructional procedures again. After the completion of each task, the teacher gave verbal praise and also gave verbal praise three times during the perofrmance of a task. (Examples of verbal praises are "nice job," "you really did that well," "you are a super student," "that was really great," etc.) A reinforcer was given to the child at the end of each treatment session.

The second hour of training was conducted with each of the teachers individually. At this time, the teacher was required to demonstrate knowledge of the experimental procedures and materials by administering treatment to a child. At this time all three teachers exhibited proficient knowledge of the procedures. The rationale and the basic experimental hypothesis was not discussed with the teachers during any of the training sessions.

Two other individuals were also trained in the experimental procedures, so that a reliability check could be conducted. These two people observed each of the three teachers a total of four times each. The teachers were rated on their performance in three different categories: (a) timings, (b) treatment order, and (c) task procedures as shown on the reliability checklist presented in Table 8.

Each item on the checklist contained either a blank or the number 0123. The blank under the Treatment category required the rater to place a check in the blank if the teacher performed this task. For these items there were only two responses, a check or the absence of a check signifying that this behavior did not occur. The blank under the Timings category required the rater to fill the blank with the amount of time used for each treatment. The blanks under the Tasks category required the raters to fill in (a) the number of processes given for a task, (b) the number of questions asked by the subject, and (c) the number of instructions given by the teacher. Under all categories the 0123 number display

Table 8

Reliability Checklist

Timings

	Order	Randomly Distributed	Accurately Recorded	Reinforced
A	0 1 2 3	( )	( )	( )
V	0 1 2 3	( )	( )	( )
D	0 1 2 3	( )	( )	( )

Treatment

	Order	Time
A	0 1 2 3	( )
V	0 1 2 3	( )
D	0 1 2 3	( )

Tasks

	Worksheets	Number of Praises	Number of Questions Asked	Number of Instructions Given
A	0 1 2 3	( )	( )	( )
V	0 1 2 3	( )	( )	( )
D	0 1 2 3	( )	( )	( )
	Link Letters			
A	0 1 2 3	( )	( )	( )
V	0 1 2 3	( )	( )	( )
D	0 1 2 3	( )	( )	( )
	Word Cards			
A	0 1 2 3	( )	( )	( )
V	0 1 2 3	( )	( )	( )
D	0 1 2 3	( )	( )	( )

required the raters to circle the order in which a particular activity occurred, whether first, second, third, or never.

The raters observed the same teacher on the same day so that an interrater reliability check was also obtained. The raters did not know which treatment(s) the teachers were to be administering and did not know in which order the timings were to be administered. Only the investigator and the teachers knew this information, thus the raters could not make any judgments about the procedures.

Data Analysis

The data were analyzed to determine (a) which stimulus characteristics caused the greatest increase in picture to word matching, (b) which stimulus characteristics required the least amount of time to reach proficiency, and (c) whether instruction using one set of stimulus characteristics influenced the performance on words used in the other stimulus conditions, i.e., did the treatments generalize? The teacher variable was analyzed to determine the influence of the teacher variable on the picture to word matching performance of each subject. This variable was also measured to determine whether or not each teacher was administering the experimental treatments in the same way to each subject.

CHAPTER IV

RESULTS

This study was conducted to determine the effects of three different stimulus characteristics of words on the picture to word matching performance of six subjects. The three different stimulus characteristics include visually similar characteristics, visually and auditorally similar characteristics, and visually and auditorally dissimilar characteristics. The effects were analyzed to determine (a) which stimulus characteristics caused the greatest increase in picture to word matching, (b) which stimulus characteristics required the least amount of time to reach proficiency, and (c) whether instruction using one set of stimulus characteristics influenced the performance on words used in the other stimulus conditions (i.e., did the treatments generalize?). In addition, the teacher variable was measured to determine (a) the influence of the teacher on the picture to word matching performance of each subject and (b) whether or not each teacher was administering the experimental treatments in the same way to each subject.

Throughout the results section notation will be used in the tables to signify each of the three stimulus conditions. V is used to signify the visually similar condition, D is used to signify the visually and auditorally dissimilar condition, and A is used to signify the visually and auditorally similar condition.

A word was counted as "learned" if the subject matched four examples of that word to four pictures within the daily timing limit of one minute. Therefore, even if a subject did not reach proficiency on an entire unit of words he may still have received credit on the daily totals for learning one or several of the words if he performed the four matches per word correctly. All five words within a unit had to be matched correctly on the same day in order for the subject to have reached proficiency and begin instruction with a new set of words.

Analysis of the Effect of Stimulus Characteristics on the Picture to Word Matching Task

Raw Score Totals

The raw scores of actual number of words learned by stimulus condition and by phase for each subject are shown in Table 9. This table also shows the total number of words learned by each subject, i.e., the number in the bottom right corner of each matrix. These raw scores reveal that the auditorally and visually dissimilar words were the words learned most frequently by each subject. In addition, the subjects performed better with the visually and auditorally similar words than with the visually similar words.

The raw score group totals for number of words learned in each stimulus condition are presented in Table 10. This table reflects the sum of all the words learned by all the subjects in each stimulus condition. The visually and auditorally dissimilar words

Table 9

Raw Data Scores Totaled by Phase

Subject 1

		Treatments					
		V	VA	VAD	AD	D	Total
Stimulus Words	D	1	4	5	7	10	27
	A	5	2	3	5	5	20
	V	0	1	3	1	0	5
	Total	6	7	11	13	15	52

Subject 2

		Treatments					
		A	AD	ADV	DV	V	Total
Stimulus Words	D	2	3	10	10	13	38
	A	5	0	10	5	1	21
	V	0	0	2	3	0	5
	Total	7	3	22	18	14	64

Table 9 - Continued

Subject 3

		Treatments					
		V	VA	VAD	AD	D	Total
Stimulus Words	D	5	7	3	2	13	30
	A	3	2	5	5	5	20
	V	1	3	1	2	2	9
	Total	9	12	9	9	20	59

Subject 4

		Treatments					
		D	DV	DVA	VA	A	Total
Stimulus Words	D	5	3	0	0	0	8
	A	1	1	1	1	1	5
	V	0	1	2	0	2	5
	Total	6	5	3	1	3	18

Table 9 - Continued

Subject 5

		Treatments					
		A	AD	ADV	DV	V	Total
Stimulus Words	D	5	5	5	13	2	35
	A	5	5	3	4	4	21
	V	1	0	1	3	5	10
	Total	11	10	9	20	16	66

Subject 6

		Treatments					
		D	DV	DVA	VA	A	Total
Stimulus Words	D	10	5	15	15	5	50
	A	5	0	10	8	7	30
	V	2	3	4	1	0	11
	Total	17	8	30	24	12	91

accounted for 53.8 percent of the total words learned. The visually and auditorally similar words accounted for 33.3 percent of this total. The visually similar words accounted for only 12.8 percent of the total number of words learned. Thus, the visually and auditorally dissimilar words produced the greater increase in picture to word matching.

Table 10

Total Number of Words Learned in Each Stimulus Condition

	D	A	V	Total
Number of Words Learned	189	117	45	351

Percentage Components

Comparative percentages of number of words learned for the three stimulus conditions for each subject are shown in Table 11. This table yields three comparisons: (a) the visually and auditorally dissimilar condition with the visually and auditorally similar condition, (b) the visually and auditorally dissimilar condition with the visually similar condition, and (c) the visually and auditorally similar condition with the visually similar condition. These same three comparisons are made with a group total as depicted in Table 12. These scores reflect the averaged results of the individual percentages. Either tabled comparison, by group or by individual, reveals a wide difference of scores among the three stimulus conditions with the visually and auditorally dissimilar words producing the greatest increase in picture to word matching.

Table 11

Comparative Percentages for Number of Words Learned

Subjects	Treatments		
	D vs. A	D vs. V	A vs. V
1	D > A by 26.0%	D > V by 81.0%	A > V by 75.0%
2	D > A by 46.8%	D > V by 86.9%	A > V by 76.2%
3	D > A by 33.3%	D > V by 70.0%	A > V by 55.0%
4	D > A by 62.5%	D > V by 62.5%	A = V
5	D > A by 40.0%	D > V by 71.5%	A > V by 52.4%
6	D > A by 40.0%	D > V by 78.0%	A > V by 63.4%

Table 12

Group Comparative Percentages for
Number of Words Learned

D vs. A	D vs. V	A vs. V
D A by 37.8%	D > V by 76.1%	A > V by 61.6%

Proficiency Analysis

Table 13 reflects the average number of days required to reach proficiency (i.e., errorless matching of 20 words to 20 pictures in one minute or less) for the three stimulus conditions by each subject. This table also reveals a group average. The proficiency averages were obtained by counting the number of proficient units obtained in each stimulus condition for each subject. These numbers were then divided by the number of days used by each subject to obtain a particular number of proficient units. For example, Subject 6 reached proficiency on the first two units of the visually similar words during the first 14 days of the experiment (see Appendix E for raw data scores). He did not become proficient with unit three after 11 more experimental days so his proficiency rate would have been determined by dividing two proficient units by 14 days for an average rate of seven days per proficient unit. Subject 4 was not counted in the group averages for two conditions in Table 13, due to the fact that he did not reach proficiency with any of the words from the visually similar condition or the visually and auditorally similar condition.

The proficiency analysis indicates that it took 1.44 days longer to reach proficiency with the visually and auditorally similar words as compared with the visually and auditorally dissimilar words. Proficiency with the visually and auditorally dissimilar words was reached 10.63 days before proficiency with the visually similar words was reached. This analysis also indicates that it took 9.63 days longer to reach proficiency with the visually similar words as compared to the visually and auditorally similar words. Thus, proficiency with the visually and auditorally dissimilar words was reached before proficiency with either of the other two stimulus conditions.

Table 13

Days to Reach Proficiency

Subject	D	A	V
1	3.15	5.00	20.00
2	4.80	5.50	20.00
3	4.17	6.25	15.00
4	5.00	0.00	0.00
5	3.57	5.60	11.50
6	2.50	4.17	7.00
Group Average	3.87	5.31*	14.70*

*Average determined by dividing total by five due to Subject 4's lack of performance.

Analysis of Stimulus Generalization Effects

Analysis by Treatment Phase

An analysis of the percentage of words learned by each subject, in each stimulus condition, by phase (i.e., experimental design) is presented in Table 14. These data show what percentage of words learned in a particular phase are attributed to one of the three stimulus conditions. These percentages were obtained by dividing the number of words learned for a particular stimulus condition by the total number of words learned in that particular phase.

During Phase I, in which each subject was receiving treatment for only one of the three stimulus conditions, three of the subjects performed better with the visually and auditorally dissimilar words; only two of these subjects were receiving treatment for this stimulus condition. Two subjects performed better with the visually and auditorally similar words; only one of these subjects was receiving treatment for this stimulus condition. One subject performed equally well with both the visually and auditorally similar words and the visually and auditorally dissimilar words, but was receiving treatment only for the auditorally and visually similar condition.

Phase II, at which time each subject was receiving treatment for two stimulus conditions, produced similar results to Phase I. Subjects 2, 4, and 6, all of whom were receiving treatment for the

Table 14

Analysis By Treatment Phase

Subject 1

		Treatments				
		V	VA	VAD	AD	D
Stimulus Words	D	16.7	57.1	45.4	53.8	66.7
	A	83.3	28.6	27.3	38.5	33.3
	V	0	14.3	27.3	7.7	0
	Total	100%	100%	100%	100%	100%

Subject 2

		Treatments				
		A	AD	ADV	DV	V
Stimulus Words	D	28.6	100.0	45.5	55.5	92.8
	A	71.4	0	45.5	27.8	7.2
	V	0	0	9.0	16.7	0
	Total	100%	100%	100%	100%	100%

Table 14 - Continued

Subject 3

		Treatments				
		V	VA	VAD	AD	D
Stimulus Words	D	55.6	58.3	33.3	22.2	65.0
	A	33.3	16.7	55.6	55.6	25.0
	V	11.1	25.0	11.1	22.2	10.0
	Total	100%	100%	100%	100%	100%

Subject 4

		Treatments				
		D	DV	DVA	VA	A
Stimulus Words	D	83.3	60.0	0	0	0
	A	16.7	20.0	33.3	100.0	33.3
	V	0	20.0	66.7	0	66.7
	Total	100%	100%	100%	100%	100%

Table 14 - Continued

Subject 5

		Treatments				
		A	AD	ADV	DV	V
Stimulus Words	D	45.5	50.0	56.0	65.0	43.8
	A	45.5	50.0	33.0	20.0	25.0
	V	9.0	0	11.0	15.0	31.2
	Total	100%	100%	100%	100%	100%

Subject 6

		Treatments				
		D	DV	DVA	VA	A
Stimulus Words	D	58.8	62.5	50.0	63.5	42.0
	A	29.4	0	33.0	33.3	58.0
	V	11.8	37.5	17.0	4.2	0
	Total	100%	100%	100%	100%	100%

visually and auditorally dissimilar stimulus condition performed better with these words than with the words from the other two stimulus conditions. Subjects 1 and 3, who were receiving treatment for the visually and auditorally similar condition, performed better with these words than with the words from the other two stimulus conditions. Subject 5 continued to perform equally well with both the visually and auditorally dissimilar and the visually and auditorally similar words while receiving treatment for both conditions.

An analysis of Phase III, at which time all of the subjects were receiving treatment for all three stimulus conditions, reveals that Subjects 1, 5, and 6 performed better with the visually and auditorally dissimilar words than with the words from the other two stimulus conditions. Subject 3 performed better with the visually and auditorally and auditorally similar words. Subject 4 performed better with the visually similar words. Subject 2 performed equally well with the visually and auditorally similar words and the visually and auditorally dissimilar words.

During Phase IV, at which time one of the three stimulus conditions was withdrawn, four of the subjects performed better with the visually and auditorally dissimilar words. Three of the subjects (1, 2, and 5) were receiving treatment for this condition. Subject 6 had received treatment for this condition during three previous phases. Subjects 4 and 5 performed better with the visually and auditorally similar words; both subjects were receiving treatment for this condition.

During Phase V, when only one treatment was being implemented, Subjects 1, 2, 3, and 5 performed better with the visually and auditorally dissimilar words. Subjects 1 and 3 were receiving treatment for this condition while Subjects 2 and 5 were receiving treatment for the visually similar words. Subject 4 performed better with the visually similar words but was receiving treatment only for the visually and auditorally similar words. Subject 6 performed better with the visually and auditorally similar words while receiving treatment for these words.

Table 15 shows the results of the analysis by phase which indicates that best performance with the visually and auditorally dissimilar words during a particular phase occurred under all three conditions: (a) before treatment for this condition was administered, (b) during treatment for this condition, and (c) after treatment for this condition was withdrawn. The visually and auditorally similar words were learned best under two conditions: (a) during treatment for this condition and (b) before treatment for the condition was administered. After treatment was withdrawn for this condition, none of the subjects achieved their best performance score in this stimulus condition. Only one of the subjects performed better, in any of the phases, with the visually similar words. This occurred once while treatment for this condition was being administered and once after treatment for this condition was withdrawn. A more precise description of these findings is presented in the following section.

Table 15

Best Performance by Treatment Phase

Phase	D			V			A		
	Before	During	After	Before	During	After	Before	During	After
I*	2	2	0	0	0	0	1	2	0
II*	0	4	0	0	0	0	0	3	0
III	0	4	0	0	1	0	0	2	0
IV	0	3	1	0	0	0	0	2	0
V	0	2	2	0	0	1	0	1	0
Total	2	15	3	0	1	1	1	10	0

*One subject performed equally as well with both the visually and auditorally similar words and the visually and auditorally dissimilar words.

Analysis By Stimulus Condition

The percentage of words learned in each stimulus condition, for each subject, is presented in Table 16. These percentages were determined by dividing the number of words learned in a particular stimulus condition phase block by the total number of words learned for that particular stimulus condition.

Visually and Auditorally Dissimilar Condition. The greatest percentage of the visually and auditorally dissimilar words were learned by several different treatment schedules. Subject 4 performed best with these words while receiving treatment for this

Table 16

Percentage By Stimulus Condition

Subject 1

	V	VA	VAD	AD	D	Total
D	3.7	14.8	18.5	26.0	[d]37.0	100
A	[a]25.0	10.0	15.0	[a]25.0	[a]25.0	100
V	0	20.0	[v]60.0	20.0	0	100

Subject 2

	A	AD	ADV	DV	V	Total
D	5.0	5.0	28.0	28.0	[d]34.0	100
A	23.8	0	[a]47.6	23.8	4.8	100
V	0	0	40.0	[v]60.0	0	100

Subject 3

	V	VA	VAD	AD	D	Total
D	16.7	23.3	10.0	6.7	[d]43.3	100
A	15.0	10.0	[a]25.0	[a]25.0	[a]25.0	100
V	11.1	[v]33.4	11.1	22.2	22.2	100

Table 16 - Continued

Subject 4

	D	DV	DVA	VA	A	Total
D	^{d}62.5	37.5	0	0	0	100
A	^{a}20.0	^{a}20.0	^{a}20.0	^{a}20.0	^{a}20.0	100
V	0	20.0	^{v}40.0	0	40.0	100

Subject 5

	A	AD	ADV	DV	V	Total
D	14.3	14.3	14.3	^{d}37.1	20.0	100
A	^{a}23.8	^{a}23.8	14.3	19.0	19.0	100
V	10.0	0	10.0	30.0	^{v}50.0	100

Subject 6

	D	DV	DVA	VA	A	Total
D	20.0	10.0	^{d}30.0	^{d}30.0	10.0	100
A	16.7	0	^{a}33.3	26.7	23.3	100
V	18.2	27.3	^{v}45.4	9.1	0	100

d - best performance with visually and auditorally dissimilar words.
a - best performance with visually and auditorally similar words.
v - best performance with visually similar words.

condition and prior to receiving treatment for any of the other stimulus conditions. Subjects 1 and 3, who were receiving treatment according to the same schedule, performed best with these words while receiving treatment only for the visually and auditorally dissimilar words but after having received three treatment phases for each of the other two stimulus conditions and two treatment phases for the visually and auditorally dissimilar words. Subject 5 performed best with the visually and auditorally dissimilar words while receiving treatment for the visually similar words and the visually and auditorally dissimilar words. This treatment phase followed three treatments with the visually and auditorally similar words, two treatments with the visually and auditorally dissimilar words, and one treatment with the visually similar words. Subject 2 performed best with these words while receiving treatment only for the visually similar words but after having received three treatment phases with the visually and auditorally dissimilar words. This subject had also received two treatment phases with the visually similar words. Subject 6 performed equally as well with the visually and auditorally dissimilar words under two conditions: (a) while receiving treatment for all three conditions, but after having received two treatment phases for the visually and auditorally dissimilar words and one treatment phase for the visually similar words; and (b) while receiving treatment for both the visually similar words and the visually and auditorally similar words but after having received three treatment phases for the visually and auditorally dissimilar words, two treatment phases for the visually similar words, and one treatment phase for the visually and auditorally similar words.

These results indicate that the visually and auditorally dissimilar words were learned best by two-thirds of the subjects when only one treatment was being administered. One half of the subjects performed best when treatment for the visually and auditorally dissimilar words was the only treatment being administered. Five of the subjects (1, 2, 3, 5, and 6) performed best with these words during or after the third treatment phase with the visually and auditorally dissimilar words and after having been exposed to both of the other stimulus conditions. The performance of Subject 4 declined with exposure to other stimulus conditions.

Table 17 summarizes these results by number of stimulus condition treatments accompanying best performance. Each subject's best performance phase for a particular stimulus condition is divided into the three stimulus condition categories: D, A, and V. These categories are further divided into three sections: 1, 2, and 3, which correspond to (1) the first treatment phase for this stimulus condition, (2) the second treatment phase for this stimulus condition, and (3) the third treatment phase for this stimulus condition. If best performance was equal in two or more phases, the first phase in which this best performance score occurred was used for this analysis. This analysis indicates that five of the six subjects' best performance with the visually and auditorally dissimilar words occurred in a phase after or during exposure to the third treatment phase for all three stimulus conditions.

Table 17

Best Performance With Visually and Auditorally Dissimilar Words

Subject	D			A			V			Total
	1	2	3	1	2	3	1	2	3	
1			X			X			X	3
2			X			X			X	3
3			X			X			X	3
4	X									1
5			X			X			X	3
6			X			X			X	3
Total	1	0	5	0	0	5	0	0	5	16

Visually and Auditorally Similar Words. Subjects 2 and 6 performed best with the visually and auditorally similar words while receiving treatment for all three stimulus conditions. Subject 2 had previously received two treatment phases with these words and one treatment phase with the visually and auditorally dissimilar words. Subject 6 had received two treatment phases with the visually and auditorally dissimilar words and one treatment phase with the visually similar words. Subject 4 performed equally as well with the visually and auditorally similar words under all conditions. Subject 1 performed equally as well with the visually and auditorally similar words during three phases: (a) while receiving treatment only for the visually similar words and prior to receiving treatment for any of the other stimulus conditions, (b) while receiving the third treatment phase for the visually and auditorally similar words and the second treatment phase for the visually and auditorally dissimilar words, and (c) while receiving only the third treatment phase for the visually and auditorally dissimilar words but after having received three treatment phases for both of the other two stimulus conditions. Subject 3 performed equally as well with the visually and auditorally similar words during three phases, two of which were the same as the (b) and (c) conditions described for Subject 1. The third condition occurred while all three treatments were being administered and the subject had received two treatment phases for the visually similar words and one treatment phase for the visually and auditorally similar words. Subject 5 performed equally well with the visually and auditorally similar words during two treatment phases: (a) while receiving treatment only for these words and prior to receiving treatment for the other two stimulus conditons and (b) while receiving the second treatment for the visually and auditorally similar words and the first treatment phase for the visually and auditorally dissimilar words.

This analysis indicates that there was a fairly stable rate of learning for the visually and auditorally similar words such that for 19 of 30 phases approximately 19 to 26 percent of the visually and auditorally similar words were learned in each phase.

This phenomenon occurred in only three out of 30 phases with the visually and auditorally dissimilar words and in only five out of 30 phases with the visually similar words. Only two subjects, Subject 2 and Subject 6, exceeded this 25 percent learning rate; Subject 2 exceeded it once, and Subject 6 exceeded it twice.

Table 18 presents a best performance analysis for the visually and auditorally similar words. This table follows the same format as Table 17. This analysis indicates that three of the subjects performed best after treatment for all three stimulus conditions. There is not a clear cut pattern by stimulus condition to best performance with the visually and auditorally similar words. The responses by stimulus condition are fairly random but the rate of learning is quite stable.

Visually Similar Words. Subjects 1, 4, and 6 performed best with the visually similar words while receiving treatment for all three stimulus conditions. Subjects 4 and 6, who were receiving treatment according to the same schedule were receiving the third treatment phase for the visually and auditorally dissimilar words, the second treatment phase for the visually similar words, and the first treatment phase for the visually and auditorally similar words. Subject 1 was receiving the third treatment phase for the visually similar words, the second treatment phase for the visually and auditorally similar words, and the first treatment phase for the visually and auditorally dissimilar words. Subject 2 performed

Table 18

Best Performance With Visually and Auditorally Similar Words

Subject	D 1	D 2	D 3	A 1	A 2	A 3	V 1	V 2	V 3	Total
1							X			1
2		X				X				2
3		X		X					X	3
4*	=	=	=	=	=	=	=	=	=	=
5			X			X			X	3
6			X	X				X		3
Total	0	2	2	2	0	2	1	1	2	12

*Subject 4 performed equally as well under all conditions.

best with the visually similar words after receiving all three treatment phases for the visually and auditorally similar words, while receiving the second treatment phase for the visually similar words and the third treatment phase for the visually and auditorally dissimilar words. Subject 3 performed best with the visually similar words while receiving the second treatment phase for the visually similar words and the first treatment phase for the visually and auditorally similar words. Subject 5 performed best with the visually similar words while receiving only the first treatment phase for the visually similar words but after having received three treatment phases each with the visually and auditorally dissimilar words and the visually and auditorally similar words.

These results indicate that half of the subjects performed best with the visually similar words when the treatment phase for this condition was administered simultaneously with the other two stimulus conditions, i.e., the Phase III condition. Five subjects performed best with the visually similar words after having at least one treatment phase with each of the three stimulus conditions. This result is shown in Table 19 which follows the same format as Tables 17 and 18. This table also illustrates that for five subjects, best performance with the visually similar words occurred during or after receiving treatment for the visually and auditorally dissimilar words and the visually similar words. For six subjects best performance occurred during or after receiving treatment for the visually and auditorally similar words.

Table 19

Best Performance With Visually Similar Words

		D			A			V		
Subject	1	2	3	1	2	3	1	2	3	Total
1	X				X				X	3
2			X			X		X		3
3				X				X		2
4			X		X		X			3
5			X			X			X	3
6			X	X				X		3
Total	1	0	4	2	2	2	1	3	2	17

Summary of Generalization Effects

The generalization analyses suggest different effects for the three different stimulus conditions. There did not appear to be much generalization from the visually similar condition and the visually and auditorally dissimilar condition to the visually and auditorally similar condition. These words were learned at a fairly consistent rate regardless of which stimulus condition treatments were being administered. After treatment for the visually and auditorally similar words was withdrawn, none of the subjects' achieved their best performance score with these words indicating that exposure to the visually and auditorally similar treatment was important for efficient learning of these words.

An opposite effect to that described for the visually and auditorally similar words was found for the visually and auditorally dissimilar words. Five of the six subjects performed best with the visually and auditorally dissimilar words after having received treatment for all three stimulus conditions. Three of these subjects performed best during the last phase of the experiment and had had maximum exposure to all the treatment conditions. Thus, for five of the subjects, the visually and auditorally dissimilar words seemed to be facilitated by the stimulus characteristics provided by the visually similar words and the visually and auditorally similar words. Subject 4 performed best with the visually and auditorally dissimilar words during the first phase of the experiment in which he was receiving treatment only for these words. This subject seemed to be confused by the addition of other stimulus characteristics.

The visually similar words seemed to be the most difficult for all of the subjects to learn. Only one subject performed better with these words during any of the five treatment phases. This was observed for Subject 4 and his performance declined after the first experimental phase, such that his scores for the visually similar words as well as for the other stimulus conditions are probably not much better than chance. The other five subjects obtained their best performance score with the visually similar words after having received treatment for either one or both of the other two stimulus conditions. This phenomenon suggests that there was some generalization from the visually and auditorally similar words and the visually and auditorally dissimilar words to the visually similar words. Even with assistance from these other characteristics, the visually similar words were not learned as effectively as the words from the visually and auditorally dissimilar condition or the words from the visually and auditorally similar condition.

Teacher Variable Analysis

Subject Comparison by Design and By Teacher

A percentage analysis of the number of words learned in each stimulus condition of each phase is presented in Table 20 for the six subjects. This analysis shows under what conditions each part of the total number of words was learned by each subject. These percentages were determined by dividing the number of words learned by each subject for each stimulus condition in each phase, by that subject's total number of words learned (refer to Table 9 for raw scores). These scores were then used to make two comparisons for a pair of subjects, a comparison by design and a comparison by teacher.

Table 20

Analysis of Percentage of Total Number of Words Learned

Subject 1

		Treatments					
		V	VA	VAD	AD	D	Total
Stimulus Words	D	1.9	7.7	9.6	13.5	19.2	51.9
	A	9.6	3.9	5.8	9.6	9.6	38.5
	V	0	1.9	5.8	1.9	0	9.6
Total		11.5	13.5	21.2	25.0	28.8	100.0

Subject 2

		Treatments					
		A	AD	ADV	DV	V	Total
Stimulus Words	D	3.0	5.0	16.0	16.0	20.0	60.0
	A	7.0	0	16.0	7.0	2.0	32.0
	V	0	0	3.0	5.0	0	8.0
Total		10.0	5.0	35.0	28.0	22.0	100.0

Table 20 - Continued

Subject 3

		Treatments					
		V	VA	VAD	AD	D	Total
Stimulus Words	D	8.5	11.9	5.1	3.4	22.0	50.9
	A	5.1	3.4	8.5	8.5	8.5	34.0
	V	1.6	5.1	1.6	3.4	3.4	15.1
	Total	15.2	20.4	15.2	15.3	33.9	100.0

Subject 4

		Treatments					
		D	DV	DVA	VA	A	Total
Stimulus Words	D	27.70	16.60	0	0	0	44.30
	A	5.55	5.55	5.55	5.55	5.55	27.75
	V	0	5.55	5.55	0	11.20	28.95
	Total	33.25	27.70	16.75	5.55	16.75	100.00

Table 20 - Continued

Subject 5

		Treatments					
		A	AD	ADV	DV	V	Total
Stimulus Words	D	7.6	7.6	7.6	19.7	10.6	53.1
	A	7.6	7.6	4.6	6.0	6.0	31.8
	V	1.5	0	1.5	4.5	7.6	15.1
Total		16.7	15.2	13.7	30.2	24.2	100.0

Subject 6

		Treatments					
		D	DV	DVA	VA	A	Total
Stimulus Words	D	11.0	5.5	16.5	16.5	5.5	55.0
	A	5.5	0	11.0	8.8	7.7	33.0
	V	2.2	3.3	5.5	1.0	0	12.0
Total		18.7	8.8	33.0	26.3	13.2	100.0

Comparison by Design. Table 21 illustrates the percentage of difference between the stimulus condition percentage scores for a pair of subjects. This difference was calculated for each of the two subjects who were receiving the experimental treatments according to the same design. The difference scores are relatively small between Subjects 1 and 3 and Subjects 2 and 5. There were broader differences between the percentage scores for Subjects 4 and 6. This broader difference could be due to the declining performance of Subject 4 upon exposure to different stimulus conditions.

Table 21

Percentage Difference Comparison By Design

	Subjects		
Stimulus Condition	1 vs. 3	2 vs. 5	4 vs. 6
D	1.00	6.90	10.70
A	4.50	.20	5.25
V	5.50	7.10	16.95

Comparison by Teacher. Table 22 compares the stimulus condition percentage differences for a pair of subjects who were receiving treatment from the same teacher. The differences between Subjects 1 and 2 and Subjects 3 and 4 are approximately the same as the differences for Subjects 1 and 3 and Subjects 2 and 5 suggesting that there is not much difference between subjects by design than by teacher. The small differences between the percentage of words learned by Subjects 5 and 6 for each of the three stimulus conditions reflects a similarity in each subject's individual rate of performance. Each subject's percentage scores were determined by comparing his stimulus condition by phase scores to his own total word score. Subject 5 actually learned 25 words less than Subject 6. There are many differences between these two subjects when the data are reviewed by phase and by stimulus condition. The basic similarity between these subjects is that both learned the same percentage of words for each of the three stimulus conditions. A comparison of the percentage scores for Subjects 3 and 5, who were receiving treatment from different teachers and according to different experimental designs, reveals similar percentage difference scores to those obtained for Subjects 5 and 6. This situation suggests that there is a similar rate of stimulus condition learning among three of the subjects which may not be due to the teacher variable. All three of these subjects were receiving treatment by a different design such that the phenomenon cannot be attributed to this factor. Therefore, the teacher variable was no more or less significant than the design variable in each subject's picture to word matching performance.

Table 22

Percentage Difference Comparison by Teacher

Stimulus Condition	Subjects 1 vs. 2 (Teacher 1)	 3 vs. 4 (Teacher 2)	 5 vs. 6 (Teacher 3)
D	8.10	6.60	1.90
A	6.50	6.25	1.20
V	1.60	12.85	3.10

Interrater Agreement Checklist

The Interrater Agreement Checklist described in Chapter III yielded two types of responses for analysis: (a) Type A responses which required the raters to perform a simple task of circling a number, placing a check in a blank or writing down the beginning and ending treatment times, and (b) Type B responses which required a judgment on the part of the raters (i.e., number of praises, number of questions asked by the child, and number of instructions given by the teacher.) These responses are called judgmental type responses because there were no specific criteria set for determining what was or was not a praise, question, or instruction. General guidelines for these responses were defined in Chapter III, but, in an attempt to avoid stereotyped interactions, specific responses were not specified. In addition, human interactions are difficult to predict, i.e., what was reinforcing to one subject may not have been to another. The raters had to make the decisions as to what was a praise, question, or instruction and fill in the appropriate blank.

The raters observed each teacher and her subjects four times during the course of the investigation. The raters performed their observations on the same day so that an interrater agreement check could be noted. The teachers were observed while administering four different phases of the experiment and did not know on what days the raters would appear. The raters, in turn, did not know which treatments were supposed to be in effect for each subject and thus, did not know whether the teachers were administering the correct treatments.

From the data generated from the interrater agreement checklist, three analyses were performed: (a) an analysis of Type A responses, (b) an analysis of Type B responses, and (c) an interrater agreement analysis.

Type A Responses. There was 100 percent agreement between the raters for all Type A responses for each subject on all observations. In general, these responses signified that the teacher was performing the appropriate task. For example, the teacher could either praise the child after a timing (for which a check was placed in a blank by the rater) or did not praise the child (for which nothing would have been placed in the blank). In addition, the teachers could only be administering one treatment at a time, so if one rater indicated that the treatment was being administered and the other rater indicated that the treatment was being administered, this would have signified more of a problem with the raters than with the teachers.

According to the raters' answers to the Type A responses, all three teachers were administering the correct treatments on the right days, praised the subjects after each timing, accurately recorded the timing scores, randomly distributed the timing cards, performed the timings in the proper order, and initiated each treatment session for approximately 15 minutes 100 percent of the time. These data are presented in Appendix F.

Type B Responses. During the performance of one of the three tasks (Worksheets, Link Letters, or Word Cards) the Type B responses required the raters to determine (a) whether the teacher had praised the child, (b) whether the child had asked a question, or (c) whether the teacher had given the child an instruction. The responses for each subject are shown in Table 23. A 0 is indicated if a behavior did not occur and thus could not have been counted. For example, a 0 would be shown if a child did not work on a particular task on the day he was observed. This behavior could not be observed because (a) the treatment session was terminated before the task could be performed, (b) treatment for a particular stimulus condition was not in effect in which case the tasks would not be performed, or (c) in the case of the worksheets, the task was performed only once for each set of words and would not be repeated.

Each response for each subject was averaged for comparison. The average was determined by adding both raters responses for a particular task across all four observations (0 were not included in the average) and dividing by the number of possible rater

Table 23

Type B Responses

Subject 1

Observation		Number of Praises									Number of Questions Asked									Number of Instructions								
		1		2		3		4		Average	1		2		3		4		Average	1		2		3		4		Average
	Rater	r_1	r_2	r_1	r_2	r_1	r_2	r_1	r_2		r_1	r_2	r_1	r_2	r_1	r_2	r_1	r_2		r_1	r_2	r_1	r_2	r_1	r_2	r_1	r_2	
Work Sheets	A	0	0	3	3	0	0	0	0	3.00	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	2.00
	V	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	D	0	0	3	5	0	0	0	0	4.00	0	0	1	1	0	0	0	0	1.00	0	0	3	3	0	0	0	0	3.00
Link Letters	A	0	0	5	4	2	3	2	2	3.00	0	0	1	1	1	1	0	0	1.00	0	0	3	4	2	1	0	0	2.50
	V	3	5	3	3	0	0	0	0	3.50	0	0	1	1	0	0	0	0	.50	1	1	1	2	0	0	0	0	1.25
	D	0	0	0	0	3	3	0	0	3.00	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	2.00
Word Cards	A	0	0	3	3	2	3	3	2	2.67	0	0	0	0	0	0	0	0	0	0	0	2	1	1	1	0	0	1.25
	V	0	0	3	2	0	0	0	0	2.50	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	1.50
	D	0	0	0	0	2	3	0	0	2.50	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	2.00
Rater Agreement		95.56		89.67		89.00		96.33			100		100		100		100			100		80.50		94.44		100		

Table 23 - Continued

Subject 2

Observation	Rater	Number of Praises									Number of Questions Asked									Number of Instructions								
		1		2		3		4		Average	1		2		3		4		Average	1		2		3		4		Average
		r_1	r_2	r_1	r_2	r_1	r_2	r_1	r_2		r_1	r_2	r_1	r_2	r_1	r_2	r_1	r_2		r_1	r_2	r_1	r_2	r_1	r_2	r_1	r_2	
Work Sheets	A	3	4	0	0	0	0	0	0	3.50	0	0	0	0	0	0	0	0	0	4	4	0	0	0	0	0	0	4.00
	V	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	D	0	0	2	2	0	0	0	0	2.00	0	0	0	0	0	0	0	0	0	0	0	4	3	0	0	0	0	1.33
Link Letters	A	2	3	3	4	0	0	0	0	3.00	0	0	1	1	0	0	0	0	.50	2	4	1	1	0	0	0	0	2.00
	V	0	0	5	5	2	2	3	2	3.17	0	0	0	0	0	0	0	0	0	0	0	3	3	1	1	1	1	1.67
	D	0	0	3	3	3	2	0	0	2.75	0	0	0	0	1	1	0	0	.50	0	0	2	1	1	1	0	0	1.25
Word Cards	A	1	1	2	1	0	0	0	0	1.25	0	0	0	0	0	0	0	0	0	1	1	2	1	0	0	0	0	1.25
	V	0	0	2	1	2	2	2	1	1.67	0	0	0	0	0	0	0	0	0	0	0	2	1	1	2	0	0	1.00
	D	0	0	0	0	2	2	0	0	1.00	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1.00
Rater Agreement		93.56		86.11		96.33		90.78			100		100		100		100			94.44		80.56		94.44		100		

Table 23 - Continued

Subject 3

Observation Rater		Number of Praises									Number of Questions Asked									Number of Instructions								
		1		2		3		4		Average	1		2		3		4		Average	1		2		3		4		Average
		r_1	r_2	r_1	r_2	r_1	r_2	r_1	r_2		r_1	r_2	r_1	r_2	r_1	r_2	r_1	r_2		r_1	r_2	r_1	r_2	r_1	r_2	r_1		
Work Sheets	A	0	0	3	3	0	0	0	0	3.00	0	0	2	3	0	0	0	0	2.50	0	0	3	4	0	0	0	0	3.50
	V	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.00	0	0	0	0	0	0	0	0	0
	D	0	0	0	0	0	0	3	3	3.00	0	0	0	0	0	0	2	2	2.00	0	0	0	0	0	0	4	3	3.50
Link Letters	A	0	0	0	0	3	3	2	3	2.75	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	2	2	1.75
	V	4	3	3	2	3	3	0	0	3.00	0	0	0	0	0	0	0	0	0	2	1	2	1	0	0	0	0	1.00
	D	0	0	0	0	2	2	0	0	2.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Word Cards	A	0	0	0	0	2	3	3	4	3.00	0	0	0	0	1	1	0	0	.50	0	0	0	0	2	1	3	3	2.25
	V	2	1	3	3	0	0	0	0	2.25	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1.00
	D	0	0	0	0	2	3	2	2	2.25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rater Agreement		91.67		96.33		92.67		93.56			100		96.33		100		100			94.44		91.67		88.89		97.22		

Table 23 - Continued

Subject 4

Observation	Rater	Number of Praises									Number of Questions Asked									Number of Instructions								
		1		2		3		4		Average	1		2		3		4		Average	1		2		3		4		Average
		r_1	r_2	r_1	r_2	r_1	r_2	r_1	r_2		r_1	r_2	r_1	r_2	r_1	r_2	r_1	r_2		r_1	r_2	r_1	r_2	r_1	r_2	r_1	r_2	
Work Sheets	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	V	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	D	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Link Letters	A	0	0	0	0	3	3	3	3	3.00	0	0	0	0	5	5	0	0	2.50	0	0	0	0	3	3	0	0	1.50
	V	0	0	3	3	3	4	4	4	3.50	0	0	0	0	0	0	0	0	0	0	0	3	3	3	3	0	0	2.00
	D	3	4	3	3	3	3	0	0	3.17	2	1	0	0	0	0	0	0	.50	3	3	0	0	0	0	0	0	1.00
Word Cards	A	0	0	0	0	3	3	3	2	2.75	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	1	2	1.17
	V	0	0	2	2	3	3	3	3	2.67	0	0	0	0	0	0	0	0	0	0	0	1	2	2	2	0	0	1.17
	D	1	1	0	0	3	2	0	0	1.75	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	.75
Rater Agreement		97.22		100		93.56		96.33			94.44		100		100		100			94.44		94.44		100		94.44		

Table 23 - Continued

Subject 5

Observation	Rater	Number of Praises									Number of Questions Asked									Number of Instructions								
		1		2		3		4		Average	1		2		3		4		Average	1		2		3		4		Average
		r_1	r_2	r_1	r_2	r_1	r_2	r_1	r_2		r_1	r_2	r_1	r_2	r_1	r_2	r_1	r_2		r_1	r_2	r_1	r_2	r_1	r_2	r_1	r_2	
Work Sheets	A	2	2	0	0	2	2	0	0	2.00	0	0	0	0	0	0	0	0	0	4	3	0	0	2	2	0	0	2.75
	V	0	0	0	0	1	2	0	0	1.50	0	0	0	0	1	2	0	0	1.50	0	0	0	0	3	3	0	0	3.00
	D	0	0	1	1	0	0	0	0	1.00	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1.00
Link Letters	A	3	3	2	1	1	1	0	0	1.83	2	2	1	1	0	0	0	0	1.50	2	2	2	2	3	3	0	0	2.67
	V	0	0	0	0	1	2	3	2	2.00	0	0	0	0	3	2	0	0	2.50	0	0	0	0	1	2	2	2	1.75
	D	0	0	4	2	3	2	2	2	2.50	0	0	1	1	0	0	0	0	.33	0	0	1	2	2	3	2	2	2.00
Word Cards	A	0	0	2	2	0	0	0	0	2.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	V	0	0	0	0	0	0	2	3	2.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	D	0	0	0	0	0	0	2	2	2.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rater Agreement		100		88.89		85.22		92.67			100		100		90.78		100			98.56		88.89		90.78		100		

Table 23 - Continued

Subject 6

Observation	Rater	Number of Praises									Number of Questions Asked									Number of Instructions								
		1		2		3		4		Average	1		2		3		4		Average	1		2		3		4		Average
		r_1	r_2	r_1	r_2	r_1	r_2	r_1	r_2		r_1	r_2	r_1	r_2	r_1	r_2	r_1	r_2		r_1	r_2	r_1	r_2	r_1	r_2	r_1	r_2	
Work Sheets	A	0	0	0	0	0	0	3	3	3.00	0	0	0	0	0	0	2	2	2.00	0	0	0	0	0	0	4	4	4.00
	V	0	0	3	4	0	0	0	0	3.50	0	0	0	0	0	0	0	0	0	0	0	3	4	0	0	0	0	3.50
	D	0	0	3	2	3	3	0	0	2.75	0	0	1	1	0	0	0	0	0.50	0	0	1	1	2	2	0	0	1.50
Link Letters	A	0	0	0	0	3	3	3	3	3.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	V	0	0	2	3	3	4	2	3	2.83	0	0	0	0	1	2	0	0	0.75	0	0	0	0	1	2	1	1	0.83
	D	2	3	3	3	3	3	0	0	2.83	0	0	0	0	1	2	0	0	0.75	2	3	1	1	1	1	0	0	1.50
Word Cards	A	0	0	0	0	0	0	2	2	2.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1.00
	V	0	0	0	0	2	3	0	0	2.50	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1.00
	D	3	3	0	0	0	0	0	0	3.00	2	2	0	0	0	0	0	0	2	1	2	0	0	0	0	0	0	1.50
Rater Agreement		96.33		89.89		93.56		96.33			100		100		88.89		100			90.78		97.22		94.44		100		

responses other than 0. The averages for each subject are compared in Table 24. A group average was determined by adding each subject's average (0 was not included in the average) and dividing by the number of possible averages. An analysis of these data reveal only minor differences among the subjects for all three categories. These results suggest that the three teachers were responding to each subject in a fairly consistent manner which further suggests that the experimental results were not substantially influenced by the teacher variable.

Interrater Agreement. An interrater agreement check was obtained by comparing the responses recorded by each of the two raters (shown in Table 23). For each observation the raters had to record 27 responses, nine for each category, i.e., praises, questions, or instructions. An agreement percentage was obtained for each category during each observation for each subject. This percentage was determined by averaging the percent of rater agreement for each response. For example, during observation 1, for Subject 1, both raters recorded an 0 response for the A, V, and D worksheets. These responses would be counted as three 100 percent agreements. For the same subject, performing the V Link Letters Task, rater one recorded that three praises were administered while rater two recorded that five praises were administered. These responses would be counted as a 60 percent agreement. Both raters recorded an 0 response for all other items in the praise category for this observation. The final percentage of rater agreement

Table 24

Percentage of Agreement Between Two Raters for Type B Responses

		Number of Praises							Number of Questions Asked							Number of Instructions						
Subject		1	2	3	4	5	6	Average	1	2	3	4	5	6	Average	1	2	3	4	5	6	Average
Work Sheets	A	3.00	3.50	3.00	Ø	2.00	3.00	2.90	0	0	2.50	Ø	0	2.00	.90	2.00	4.00	3.50	Ø	2.75	4.00	3.25
	V	Ø	Ø	Ø	Ø	1.50	3.50	2.50	Ø	Ø	Ø	Ø	1.50	0	.75	Ø	Ø	Ø	Ø	3.00	3.50	3.25
	D	4.00	2.00	3.00	Ø	1.00	2.75	2.55	1.00	0	2.00	Ø	0	.50	.70	3.00	1.33	3.50	Ø	1.00	1.50	2.06
Link Letters	A	3.00	3.00	2.75	3.00	1.83	3.00	2.76	1.00	.50	0	1.67	1.50	0	.78	2.50	2.00	1.75	1.50	2.33	0	1.68
	V	3.50	2.17	3.00	3.50	2.00	2.83	3.00	.50	0	0	0	1.50	.75	.46	1.25	1.67	1.00	2.00	1.75	.83	1.41
	D	3.00	2.75	2.00	3.17	2.50	2.83	2.70	0	.50	0	.50	1.00	.75	.46	2.00	1.25	0	1.00	2.00	1.50	1.29
Word Cards	A	2.67	1.25	3.00	2.75	Ø	2.00	2.33	0	0	.5	0	0	0	.08	1.25	1.25	2.25	1.17	0	1.00	1.15
	V	2.50	1.67	2.25	2.67	2.50	2.50	2.34	0	0	0	0	0	0	0	1.50	1.00	.50	1.17	0	1.00	.86
	D	2.50	1.00	2.25	1.75	2.00	3.00	2.08	0	0	0	0	0	2.00	.33	2.00	1.00	0	.75	0	1.50	.87

would be determined by averaging eight 100 percent agreements with a 60 percent agreement for an interrater agreement score of 95.56.

A comparison of the agreement percentage is presented in Table 25. As revealed by this display the agreement scores are high, ranging from 80.5 to 100 percent. Eighty-four percent of these responses were in the 90 to 100 percent range. These results suggest that the raters were in close agreement during the observation sessions and lend further support to the previous suggestion that the experimental results were not influenced by the teacher variable.

Summary of the Teacher Variable Analysis

Neither the experimental design nor the teacher appeared to influence the experimental outcome. The interrater agreement check suggested that all three teachers were performing the experimental procedure correctly and in the same manner. The raters consistently agreed with each others observations indicating that the results are reliable. These results strongly suggest that the teacher variable was not a factor in determining the experimental results.

Table 25

Agreement Percentages Between Two Observers for Four Observations

		Number of Praises					Number of Questions					Number of Instructions				
	Observations	1	2	3	4	Average	1	2	3	4	Average	1	2	3	4	Average
Subjects	1	95.56	89.67	89.00	96.33	92.14	100.00	100.00	100.00	100.00	100.00	100.00	80.50	94.44	100.00	93.74
	2	93.56	86.11	96.33	90.78	91.70	100.00	100.00	100.00	100.00	100.00	94.44	80.56	94.44	100.00	92.36
	3	91.67	96.33	92.67	93.56	93.56	100.00	96.33	100.00	100.00	99.10	94.44	91.67	88.89	97.22	93.06
	4	97.22	100.00	93.56	96.33	96.78	94.44	100.00	100.00	100.00	98.60	94.44	94.44	100.00	94.44	95.83
	5	100.00	88.89	85.22	92.67	91.70	100.00	100.00	90.78	100.00	97.70	98.56	88.89	90.78	100.00	94.56
	6	96.33	89.89	93.56	96.33	93.34	100.00	100.00	88.89	100.00	97.20	90.78	97.22	94.44	100.00	95.61

CHAPTER V

DISCUSSION AND IMPLICATIONS

The problem of reading failure has been approached by many and varied researchers in many and varied ways. Different teaching styles, methods, and programs have been investigated, yet none has been wholeheartedly supported by research professionals or teachers.

A substantial research effort has been spent in comparing one type of reading program to another without much regard for the many different task components contained in each program. Reading programs differ according to such things as word meanings, sentence length, degree of rhyming, repetition of words, word configuration, number of sounds introduced, number and size of pictures, familiarity with names and places, and interest level of the stories. Without consideration for many of these factors, a comparison of one total reading approach to another is useless information.

This study was designed to analyze one aspect of the reading process: the stimulus characteristics of words and their effect on the picture to word matching performance of six learning disabled children. This research was not intended to be a comparison of reading methods yet the stimulus characteristics of the reading material are one of the major factors by which commercial reading programs differ. In addition, learning disabled children are a population known to frequently manifest reading problems. Some researchers attribute this particular type of reading failure to minimal brain dysfunction, however, oftentimes there is no detectable brain injury in the child yet the reading problem persists. Perhaps, many reading problems are not due to neurological deficits but are a function of the presentation of inappropriate reading stimuli. This study was designed to systematically investigate one of many stimulus factors, the stimulus characteristics of words, to determine whether or not this factor was capable of producing differences in a learning disabled child's ability to match pictures to words.

Findings

Picture to Word Matching Performance

The major findings of this study will be discussed in response to the experimental questions. The first question asks which stimulus characteristics produced the greatest increase in picture to word matching.

Visually and Auditorally Dissimilar Words. All six subjects performed best with the words displaying the visually and auditorally dissimilar characteristics. In addition, all six subjects performed better with the visually and auditorally similar words than with the visually similar words.

The finding that 37.8 percent more words were learned by the visually and auditorally dissimilar condition as compared with the visually and auditorally similar condition indicates that there was a major difference between these two categories of words. The poor performance effect produced by the visually similar words further indicates that there were differences among all three categories of words. The words from all three stimulus categories were semantically equivalent and all of the experimental words were on approximately the same academic level since they were all selected from primary level reading books. Thus the major difference between the visually and auditorally dissimilar words and the words belonging to the other two stimulus categories appears to be the stimulus characteristics of the words, i.e., maximal contrast characteristics versus minimal contrast characteristics. The visually and auditorally dissimilar words in a unit did not look alike or sound alike. These words were composed of different number of letters and began and ended with different sound combinations. Many "clues" to word decoding were provided by these stimulus characteristics. Each word in a unit was distinctly different from every other word in that unit facilitating quick and efficient word recognition for the picture to word matching task.

Visually Similar Words and Visually and Auditorally Similar Words. Both the visually similar words and the visually and auditorally similar words are classified as minimal contrast words. The visually and auditorally similar words differ from the visually similar words by one distinct characteristic, i.e., the visually similar words in a unit began with the same two letters/sounds while the visually and auditorally similar words ended with the same three letters/sounds. Sixty-seven percent more words were learned with the visually and auditorally similar characteristics as compared with the words containing the visually similar characteristics. This difference could reveal an important factor in word attack skills, i.e., when decoding words, it is more important for the initial word characteristics to be visually and auditorally contrasting as compared with the final characteristics.

Proficiency Rates

The second experimental question involves counting the number of days needed by each subject to reach proficiency with a set of words. This question asks which stimulus characteristics require the least amount of time to reach proficiency.

Visually and Auditorally Dissimilar Words. The visually and auditorally dissimilar words required the least amount of time to reach proficiency on a unit of words. As discussed in response to question one, the contrasting characteristics of these words seemed to facilitate the matching process. Several subjects became quite good at decoding these words and towards the end of the experiment required less and less time to reach proficiency. This was not true for the visually similar words. These words remained difficult to decode throughout the experiment and proficient learning of these words required three times as many days as the same amount of learning with the visually and auditorally dissimilar words.

Visually and Auditorally Similar Words. The visually and auditorally similar words were learned at a slower rate than the visually and auditorally dissimilar words, yet at a faster rate than the visually similar words. This result reflects the same trend as that discussed for question one. The quicker the child's ability to decode words, the quicker he could perform a picture to word match and thus reach proficiency. The visually and auditorally dissimilar words appeared to be the easiest to figure out and the visually and auditorally similar words were next easiest.

Generalization Effects

The third experimental question involves the determination of the generalizability of the three types of stimulus characteristics. This question asks whether instruction using one set of stimulus characteristics influences the child's performance on words used in the other stimulus conditions.

Visually and Auditorally Similar Words. The learning rate for the visually and auditorally similar words was fairly consistent regardless of which treatments were in effect. Thus, there did not appear to be any significant generalization effects from the visually and auditorally dissimilar treatments or the visually similar treatments to the visually and auditorally similar words.

Visually Similar Words. The visually similar words were learned best after the subjects had been exposed to all three stimulus treatments. Whether practice with the visually and auditorally similar words and the visually and auditorally dissimilar words facilitated the visually similar words is not clear since these words were not learned rapidly under any conditions. Perhaps practice with the visually similar words alone would have produced the same result. If there were generalization effects from the other two stimulus conditions, these effects were minimal and not strong enough to compensate for the inherent difficulty of the visually similar words. The distinctive feature differentiating the visually similar words from one another were provided by the final characteristics of the words. The reading process is performed from left to right and inexperienced readers may look for an instant clue in the first letters of each word. Having to look at the end of a word in order to decode it does not seem to be an efficient learning strategy. Since this is not the primary strategy used to decode the visually and auditorally similar words or the visually and auditorally dissimilar words, practice with these two word types may actually have inhibited learning of the visually similar words. As previously discussed, it is not possible to determine exactly what effects the visually and auditorally similar treatments and the visually and auditorally dissimilar treatments had on the visually similar words.

Visually and Auditorally Dissimilar Words. The visually and auditorally dissimilar words appeared to be facilitated by the visually similar treatments and the visually and auditorally similar treatments as displayed by each subject's best performance (with the exception of Subject 4) with these words after having been exposed to all three treatment types. In fact, half of the subjects performed best with the visually and auditorally dissimilar words after having had maximum exposure to all the treatments. This finding seems quite plausible in view of the fact that two different word decoding strategies are needed to decode the visually similar words (different endings) and the visually and auditorally similar words (different beginnings). Both of these strategies could be used to decode the visually and auditorally dissimilar words. Yet, the visually similar decoding strategy could not be used to decode visually and auditorally similar words and vice versa. For example, the visually and auditorally dissimilar words were distinctly different from each other with both initial and final characteristics so that the subject could conceivably figure out any of the words by looking at the beginning or ending letters. Thus, generalization effects from the visually similar treatments and the visually and auditorally similar treatments could have greatly facilitated the visually and auditorally dissimilar words.

Subject 4 began the experimental treatment with the visually and auditorally dissimilar words and performed quite well initially. With the addition of one or two other stimulus treatments, this subject appeared to become confused. He had been quite pleased with his performance during the first week of the experiment but later became very discouraged. He frequently commented that he did not know at which end of the word to look. This comment might indicate that he could not cope with the different types of word decoding strategies presented by the experimental stimuli. On the other hand, he may have become tired after the first treatment interval and could not perform well for longer than 15 minutes. His performance did not improve during the last phase of the experiment when only one treatment was again in effect.

Reliability of Findings

The experimental treatments were administered by three different teachers, thus there was a chance for the teacher variable to influence the experimental outcome. As described in Chapter IV the interrater agreement checklist determined that all three teachers were performing the experiment consistently and correctly and were responding to each subject in the same manner. Thus, the teacher variable played an insignificant role in determining the results. The experimental design did not appear to influence the results either, as the closest percentages of words learned were obtained by three subjects who were receiving treatment according to three different experimental designs.

Implication of Findings

The preceding discussion lends much support to the notion that reading material presenting appropriate stimulus characteristics could facilitate the learning of words, i.e., as in this study the visually and auditorally dissimilar characteristics of words facilitated the picture to word matching performance of learning disabled children. All of the subjects who participated in this study had experienced much failure with the reading process. For five of these subjects the experimental treatment provided them with their first successful experiences with any reading tasks. The results of this study imply that the stimulus characteristics of words are an important variable in the reading process. Though all of the subjects performed best with the visually and auditorally dissimilar words, there appeared to be generalization effects from the visually similar words and the visually and auditorally similar words.

Even though the visually and auditorally dissimilar words seemed to be facilitated by the visually similar characteristics and the visually and auditorally similar characteristics, more of the visually and auditorally dissimilar words were learned in nearly every experimental phase than either of the other two types of words. This suggests that no matter which experimental conditions were in effect, the visually and auditorally dissimilar words were learned more efficiently than the visually similar words or the visually and auditorally similar words.

The results of this study strongly imply that the best approach to the initial reading task is with visually and auditorally dissimilar words. This approach seems logical when the experimental stimulus characteristics are analyzed by the model of reading described by Kirk, Klibhan, and Lerner (1978). This model presents reading in three phases (a) reading wholes (which requires the child to memorize words by sight), (b) learning details (which requires the child to discriminate between words and acquire sound symbol relationships), and (c) reading without awareness of details (which requires refined reading skills in order to increase vocabulary and improve comprehension).

Mercer and Mercer (1979) place both of the first two stages of the Kirk et al. model into the initial reading category. The third stage is referred to by Mercer and Mercer as the stage of rapid development of reading skills. Thus, only the first two stages of the model apply to the present study. The visually and auditorally dissimilar words may be considered as "reading wholes." The visually similar words and the visually and auditorally similar words should be considered as "learning details." According to this model, the visually and auditorally dissimilar words are the first type of words which are supposed to be learned by children. The visually similar words and the visually and auditorally similar words are supposed to be learned at a later stage after the child has had experience with the visually and auditorally dissimilar words.

The model described by Kirk, Klibhan, and Lerner (1978) was developed as a normative model for reading, thus the experimental results from the present research would generalize to a normal population of beginning readers and support the Kirk et al. model. In addition, studies performed with mentally retarded children suggest that this population also benefits from instruction with stimuli characterized by marked contrasts (Bilsky & Heal, 1969; Fisher & Zeaman, 1973; Switzky, 1973; Zeaman, 1973; Zeaman & House, 1963). These children might also benefit from reading instruction with words containing visually and auditorally dissimilar characteristics.

Suggestions for Further Research

Many investigators have reported that learning disabled children frequently manifest visual attention problems (Atkinson & Seunath, 1973; Elkind, Larson, & VanDoorminck, 1965; Hallahan, Kauffman, & Ball, 1973; Mondani & Tutko, 1969; Sabatino & Ysseldyke, 1972; Tarver, Hallahan, Kauffman, & Ball, 1976) or auditory attention problems (Baker & Maddell, 1965; Conners, Kramer, & Guerra, 1969; Lasky & Tobin, 1973). These children are often identified by the persistant manifestation of a reading problem. Words contain many different types of stimulus characteristics and are learned as a complex of features (Gibson, 1965, 1971). It has been suggested that a reading disability could occur when a child is unable to distinguish between word stimuli requiring fine feature discriminations (Bellutino, Pruzek, Steger, & Meshoulam, 1973; Vellutino, Harding, Phillips, & Steger, 1975; Vellutino, Steger, DeSetto, & Phillips, 1975; Vellutino, Steger, Kaman, & DeSetto, 1975). This report indicates that word learning might be facilitated by eliminating stimuli containing redundant elements such as visually similar characteristics or visually and auditorally similar characteristics. This component of the reading process has been relatively unexplored.

There is a need to explore the stimulus characteristics of reading material particularly that which is presented to learning disabled children. This study described a learning method which relied primarily on the visual modality. The visually and auditorally similar words may be learned more rapidly than the visually similar words or the visually and auditorally dissimilar words if an auditory component were used with the same experimental stimulus conditions, i.e., a tape recorded auditory task in which the subject heard the words while he was performing a task.

Another treatment condition could be added to this experiment to determine the effects of words which looked alike and sounded alike, yet had different meanings; homonyms. In addition, each of these three experimental treatment conditions previously described (visually similar, visually and auditorally similar, and visually and auditorally dissimilar) could be administered in isolation. The research described in this study could also be performed with normal children to determine whether the experimental effects reported in this investigation are characteristic only of learning disabled children.

An important feature of the visually and auditorally dissimilar category is that any group of words can be taught as visually and auditorally dissimilar words. Words within a group are classified according to the stimulus characteristics of the other words in the group, therefore the visually similar words, the visually and auditorally similar words, and virtually any set of words can be reclassified to fit the visually and auditorally dissimilar category.

An interesting study would be to teach the visually similar words and the visually and auditorally similar words from this study as visually and auditorally dissimilar words and compare this learning rate to the rates obtained for all three categories of stimulus words reported here.

Other components of reading programs, such as interest level, word meanings, etc., should also be investigated to determine the significance of their effects on the reading performance of children. These components should be researched in isolation and in conjunction with other components such as the stimulus characteristics of words. Only with a systematic approach to reading research will progress be made towards understanding the phenomenon of reading failure. The research described here represents an attempt to systematically investigate one component of reading programs; the stimulus characteristics of words. The results of this investigation were analyzed to determine the effects of these characteristics on the picture to word matching performance of learning disabled children.

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APPENDICES

APPENDIX A

FLORIDA CRITERIA FOR SPECIFIC LEARNING DISABILITY

1. Criteria for Eligibility

   a. A student with a specific learning disability is one who exhibits a disorder in one or more of the basic psychological processes involved in understanding or in using spoken and written language. These may be manifested in disorders of listening, thinking, reading, talking, writing, spelling, or arithmetic. They include conditions which have been referred to as perceptual handicap, brain injury, minimal brain dysfunction, dyslexia, developmental aphasia, etc. They do not include learning problems which are due primarily to visual, hearing, or motor handicaps, to mental retardation, emotional disturbance, or to an environmental disadvantage.

   b. A student of school age who meets the following criteria:

      (1) Exclusion of mental retardation, as evidenced by a score of not less than -2 standard deviations on an individual test of intelligence, with interpretation of a certified psychologist;

      (2) Exclusion of blind or partially sighted, as evidenced by visual acuity in the better eye with best possible correction of 20/70 or better;

      (3) Exclusion of deaf or hard of hearing, as evidenced by auditory acuity of no more than a 30 db loss in the better ear unaided, and speech and language learned through normal channels;

      (4) Exclusion of physical handicap; no evidence of a primary physical handicap which is directly related to the child's deficit area;

      (5) Exclusion of emotional disturbance of such a severe nature that a therapeutic-affective instructional program is needed;

      (6) Evidence of an academic disorder. Based on a student's Expectancy Age (E.A.), a score in the lower 10th percentile in one area, or lower than the 20th percentile in two or more of the following areas, as measured by standardized tests:

Academic Areas: Reading
Writing
Arithmetic
Spelling
Pre-academic skills

For children in grades K-2, evidence must be presented that the achievement level is substantially below the expected level on pre-academic tasks which require listening, thinking, or speaking skills.

(7) Evidence of a process disorder. Based on a student's Expectancy Age (E.A.) a score of less than -2 standard deviations in one area or scores of less than -1.5 standard deviations in three or more areas which measure the following basic psychological processes; or based on a student's Expectancy Age (E.A.) a score of less than 70% E.A. in one area or 80% E.A. in three or more areas which measure the following basic psychological processes:

(a) Visual Processing:

perception (discrimination and closure)
memory
association
reception

(b) Auditory Processing:

perception (discrimination and closure)
memory
association
reception

(c) Haptic Processing:

tactile
kinesthetic

(d) Language (any meaningful communication):

receptive
expressive

(e) Sensory-integration:

visual-motor
auditory-motor
auditory-vocal
visual-auditory (vocal)

The Expectancy Age will be determined by using the formula ($EA = \frac{2MA + CA}{3}$).

APPENDIX B

PRETEST

1. boil
2. snake
3. flower
4. foil
5. state
6. grape
7. brick
8. snail
9. web
10. town
11. chair
12. lion
13. bowl
14. bell
15. pipe
16. sing
17. wagon
18. fort
19. lake
20. frown
21. fish
22. tiger
23. bread
24. skate
25. rug
26. nail
27. tent
28. elephant
29. hair
30. corn
31. ring
32. house
33. door
34. witch
35. glass
36. ball
37. leg
38. eat
39. chicken
40. jeep
41. train
42. boot
43. cake
44. baby
45. gate
46. girl
47. foot
48. tail
49. truck
50. pair
51. vase
52. break
53. shoes
54. mask
55. plant
56. crown
57. bake
58. desk
59. book
60. date
61. pail
62. star
63. bee
64. bike
65. block
66. apple
67. food
68. fair
69. sock
70. horse
71. braid
72. gown
73. block
74. milk
75. rake
76. bed
77. lock
78. boat
79. sail
80. table
81. fork
82. rock
83. stair
84. jar
85. flag
86. clown
87. run
88. plate
89. spoon
90. smile
91. cow
92. pig
93. tree
94. pot
95. pen

APPENDIX C

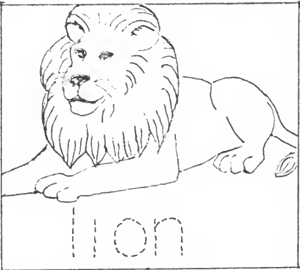
WORKSHEET INSTRUCTIONS

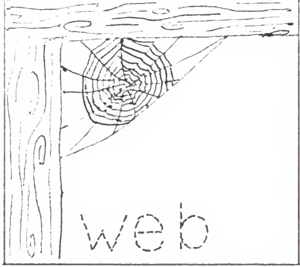
1. Connect the dots
2. Circle the initial sound
3. Fill in the blank with the initial sound
4. Circle the correct picture
5. Match each word to the correct picture
6. Match each word to the word identical to it
7. Fill in the block with the correct word
8. Write the correct word under the picture
9. Unscramble each word
10. Write the word that rhymes with each word

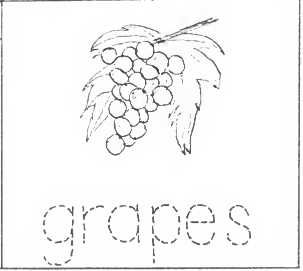
The subjects used in the study could not have read written instructions, but did not need them since they were already familiar with the style of the worksheets.

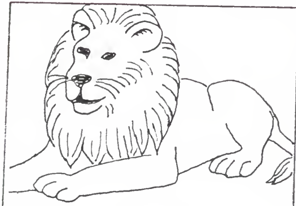
APPENDIX D

EXPERIMENTAL WORKSHEETS





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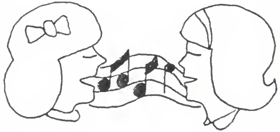
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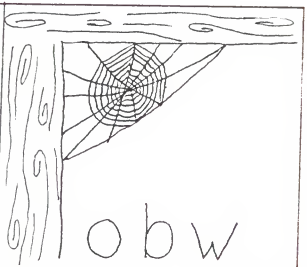
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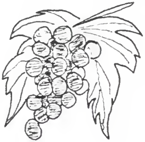

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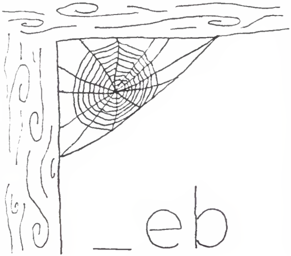

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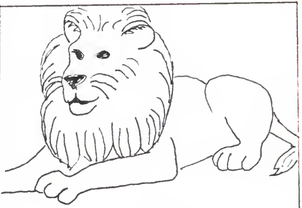

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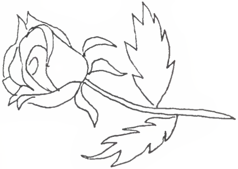

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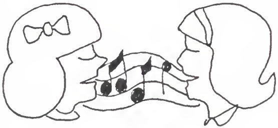

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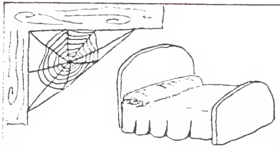
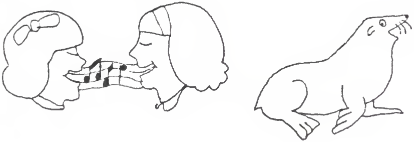


web

flower

grapes



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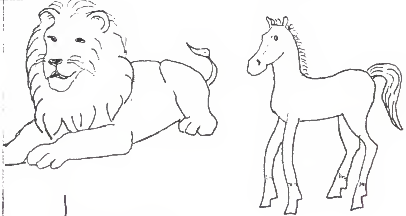
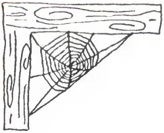


lion



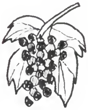
flower

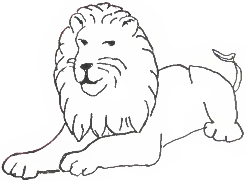
sing

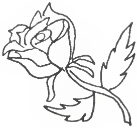
web

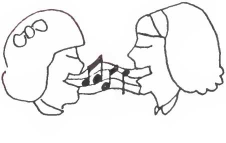
lion

grape









flower

sing

web

lion

grape

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sing

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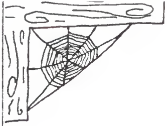
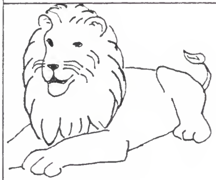
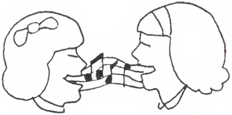
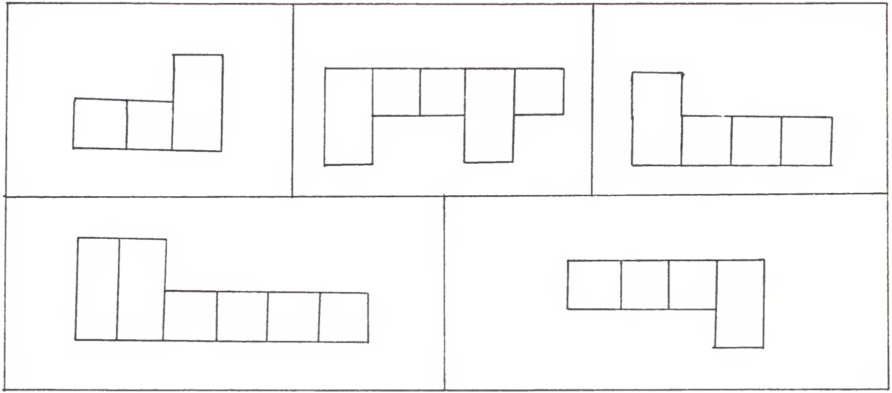
lion







grape lion sing
web flower



grape lion sing
web flower

zion
_ _ _ _

deb
_ _ _

ring
_ _ _ _

shower
_ _ _ _ _ _

drape
_ _ _ _ _

grape lion sing
web flower

bwe

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wfeolr

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nolı

_ _ _ _

grape lıon sıng

web flower

APPENDIX E

EXACT TREATMENT ORDERS

Subjects 1 and 3

Day	Timings Order	Treatment Order
1	DAV	V
2	AVD	V
3	VDA	V
4	DAV	V
5	AVD	V
6	VDA	AV
7	DAV	VA
8	AVD	AV
9	VDA	VA
10	DAV	AV
11	AVD	DVA
12	VDA	VAD
13	DAV	ADV
14	AVD	DVA
15	VDA	VAD
16	DAV	DA
17	AVD	AD
18	VDA	DA
19	DAV	AD
20	AVD	DA
21	VDA	A
22	DAV	A
23	AVD	A
24	VDA	A
25	DAV	A

Subjects 2 and 5

Day	Timings Order	Treatment Order
1	AVD	A
2	VDA	A
3	DAV	A
4	AVD	A
5	VDA	A
6	DAV	DA
7	AVD	AD
8	VDA	DA
9	DAV	AD
10	AVD	DA
11	VDA	ADV
12	DAV	DVA
13	AVD	VAD
14	VDA	ADV
15	DAV	DVA
16	AVD	VD
17	VDA	DV
18	DAV	VD
19	AVD	DV
20	VDA	VD
21	DAV	V
22	AVD	V
23	VDA	V
24	DAV	V
25	AVD	V

Subjects 4 and 6

Day	Timings Order	Treatment Order
1	VDA	D
2	DAV	D
3	AVD	D
4	VDA	D
5	DAV	D
6	AVD	VD
7	VDA	DV
8	DAV	VD
9	AVD	DV
10	VDA	VD
11	DAV	DVA
12	AVD	VAD
13	VDA	ADV
14	DAV	DVA
15	AVD	VAD
16	VDA	AV
17	DAV	VA
18	AVD	AV
19	VDA	VA
20	DAV	AV
21	AVD	A
22	VDA	A
23	DAV	A
24	AVD	A
25	VDA	A

APPENDIX F

PERCENTAGE OF AGREEMENT BETWEEN TWO RATERS FOR TYPE A RESPONSES

Timings

Subject	Order	Randomly Distributed	Accurately Recorded	Reinforce
1	100	100	100	100
2	100	100	100	100
3	100	100	100	100
4	100	100	100	100
5	100	100	100	100
6	100	100	100	100

Treatment

Subject	Order	Time
1	100	100
2	100	100
3	100	100
4	100	100
5	100	100
6	100	100

APPENDIX G

RAW DATA

Subject: 1
Teacher: 1
Stimulus Condition: Visually Similar Words

V I	Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
book		0	0	1	0	2	1	2	1	2	3	3	1	4	3	1	3	3	3	4	4					
boot		0	0	0	0	1	2	2	2	2	3	2	4	2	1	4	3	2	3	4	4					
boat		0	0	2	2	2	1	2	2	1	3	3	3	2	3	1	3	3	3	3	4					
bowl		0	0	0	0	0	0	1	2	4	4	4	1	3	4	2	4	3	3	4	4					
boil		0	0	0	0	0	0	2	1	0	3	4	4	4	4	2	3	2	2	3	4					
Time (sec.)		60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	54					

V II	Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
fork																						0	2	1	0	0
foot																						0	1	2	2	1
food																						1	3	3	2	1
fort																						0	2	1	2	2
foil																						1	2	1	0	0
Time (sec.)																						60	60	60	60	60

Subject: 1
Teacher: 1
Stimulus Condition: Visually and Auditorally Dissimilar Words

D I	Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
grape		0	0	0	0	2	1	4	3	4																
lion		0	0	0	2	2	1	2	1	4																
web		0	2	3	2	1	1	3	4	4																
sing		0	0	1	2	1	3	3	1	4																
flower		0	0	3	0	4	2	2	1	4																
Time (sec.)		60	60	60	60	60	60	60	60	59																

D II	Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
corn											0	0	2	4												
leg											1	2	2	4												
chicken											1	0	2	4												
train											1	0	1	4												
baby											1	1	3	4												
Time (sec.)											60	60	60	60												

D III Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
plant														2	3	1	3	4							
truck														2	1	3	3	4							
tiger														3	1	2	4	4							
rug														1	1	3	4	4							
wagon														2	2	2	4	4							
Time (sec.)	60	60	60	60	58																				

D IV Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
mask																			3	4	2	4			
vase																			3	4	4	4			
horse																			3	2	3	4			
apple																			2	3	3	4			
girl																			2	3	3	4			
Time (sec.)																			60	60	60	53			

D V	Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
spoon																								4	4	
table																								4	4	
milk																								4	4	
flag																								4	4	
bed																								2	4	
Time (sec.)																								60	56	

D VI	Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
phone																										3
jeep																										1
eat																										2
splash																										2
ride																										2
Time (sec.)																										60

Subject: 1
Teacher: 1
Stimulus Condition: Visually and Auditorally Similar Words

A I	Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
snake		1	1	2	3	4																				
lake		0	0	3	3	4																				
bake		1	0	1	3	4																				
rake		0	1	1	3	4																				
cake		1	1	2	3	4																				
Time (sec.)		60	60	60	60	55																				

A II	Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
state							1	0	2	2	4	2	2	3	4											
plate							0	1	0	3	4	2	3	2	4											
date							0	1	2	2	3	4	3	4	4											
gate							2	3	2	3	3	4	3	3	4											
skate							1	0	1	3	3	2	3	3	4											
Time (sec.)							60	60	60	60	60	60	60	60	48											

A III	Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
sail																1	1	3	3	4						
pail																2	1	3	4	4						
nail																2	2	3	4	4						
tail																2	2	3	2	4						
snail																0	0	3	3	4						
Time (sec.)																60	60	60	60	60						

A IV	Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
stair																					2	2	4			
fair																					2	3	4			
chair																					4	4	4			
pair																					1	4	4			
hair																					1	2	4			
Time (sec.)																					60	60	60			

A V	Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
town																								2	3	1
clown																								1	3	3
crown																								2	2	0
gown																								1	0	0
frown																								2	3	2
Time (sec.)																								60	60	60

Subject: 2
Teacher: 1
Stimulus Condition: Visually Similar Words

V I	Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
boat		0	0	0	1	0	0	0	1	0	0	1	2	1	0	3	1	1	4	4	4					
boot		0	0	1	0	0	0	0	1	2	1	2	3	2	0	1	3	2	2	3	4					
book		0	1	1	0	2	0	0	0	2	1	2	2	1	3	4	2	3	3	4	4					
bowl		0	0	0	0	0	1	0	1	0	0	2	1	2	0	2	0	0	3	3	4					
boil		0	2	0	0	0	0	0	0	0	1	4	3	1	0	2	1	0	2	2	4					
Time (sec.)		60	60	60	33	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60					

V II	Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
foil																						0	3	3	2	3
fort																						2	0	3	3	3
fork																						1	0	3	1	3
food																						0	2	0	0	0
foot																						1	0	0	1	2
Time (sec.)																						60	60	60	60	60

Subject: 2
Teacher: 1
Stimulus Condition: Visually and Auditorally Dissimilar Words

D I	Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
lion		0	2	4	4	1	4	0	2	3	4															
grape		2	0	2	3	1	4	3	3	4	4															
web		0	2	0	4	2	3	3	2	3	4															
sing		1	3	2	3	3	3	2	1	3	4															
flower		1	2	1	2	2	3	1	1	4	4															
Time (sec.)		60	60	60	60	60	60	60	60	60	51															

D II	Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
corn												4	4													
leg												4	4													
chicken												3	4													
baby												4	4													
train												3	4													
Time (sec.)												60	59													

D III	Day 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
truck													1	3	4	4									
tiger													3	3	4	4									
wagon													3	4	4	4									
rug													2	4	3	4									
plant													3	4	3	4									
Time (sec.)													60	60	60	56									

D IV	Day 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
apple																	4								
mask																	4								
girl																	4								
vase																	4								
horse																	4								
Time (sec.)																	55								

D V	Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
flag																			2	3	4					
table																			3	4	4					
bed																			3	4	4					
spoon																			2	3	4					
milk																			3	4	4					
Time (sec.)																			60	60	52					

D VI	Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
jeep																						4				
phone																						4				
eat																						4				
ride																						4				
splash																						4				
Time (sec.)																						58				

D VII Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
bill																						4			
tent																						4			
elephant																						4			
fish																						4			
pipe																						4			
Time (sec.)																						60			

D VIII Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
pen																							3	0	1
tree																							0	4	4
cow																							0	3	2
pig																							4	0	3
pot																							1	3	4
Time (sec.)																							60	60	60

Subject: 2
Teacher: 1
Stimulus Condition: Visually and Auditorally Similar Words

A I	Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
snake		3	3	4	3	4																				
lake		3	4	3	4	4																				
cake		1	2	4	4	4																				
bake		2	4	3	3	4																				
rake		2	2	4	4	4																				
Time (sec.)		60	60	60	60	60																				

A II	Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
plate							2	2	0	0	1	3	3	4												
date							3	0	3	1	2	1	3	4												
gate							3	2	3	1	3	4	3	4												
state							1	2	3	1	3	4	4	4												
skate							1	2	1	3	2	4	4	4												
Time (sec.)							60	60	60	60	60	60	60	60												

A III	Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
sail															2	4										
snail															2	4										
nail															3	4										
pail															3	4										
tail															4	4										
Time (sec.)															60	29										

A IV	Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
fair																	2	4	2	3	4					
stair																	2	2	3	4	4					
chair																	4	1	3	3	4					
pair																	2	4	3	4	4					
hair																	3	4	3	3	4					
Time (sec.)																	60	60	60	60	59					

A V	Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
frown																						2	3	2	3	3
gown																						0	0	0	3	0
town																						3	3	2	4	2
crown																						0	0	2	0	0
clown																						1	0	2	0	1
Time (sec.)																						60	60	60	60	60

Subject: 3
Teacher: 2
Stimulus Condition: Visually Similar Words

V I	Day 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
boot	2	4		4	3	3	3	4	3	4	4	2	3	4	4										
book		3	3	2	1	1	3	4		4	3	4	4	3	4										
boat	1	1	2	3	3	4	3	3	4	4	4	3	4	4	4										
bowl	1	3			1	1		3	3	4	4	3	3	4	4										
boil		3	3		1	3		2	3	3	3	4	4	4	4										
Time (sec.)	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60										

V II	Day 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
foil																3	1	2	2	1	1	3	4	4	4
food																0	0	0	0		3	1	4	4	4
fort																0	4	4	0	2	1	0	0	0	2
fork																4	1	0	3	3	2	0	3	3	4
foot																0	0	1	2		1	0	1	1	4
Time (sec.)																60	60	60	60	60	60	60	60	60	60

Subject: 3
Teacher: 2
Stimulus Condition: Visually and Auditorally Dissimilar Words

D I	Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
grape		3	2	4																						
flower		3	1	4																						
sing		2	4	4																						
web		2	3	4																						
lion		3	4	4																						
Time (sec.)		60	60	60																						

D II	Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
leg					1	1		2	3	4																
chicken					1	1			4	4																
corn					1	1	1	1	3	4																
baby					1	1	1	2	3	4																
train					1	3	3	4	1	4																
Time (sec.)					60	60	60	60	60	60																

D III	Day 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
tiger										2	2	4		2	2	3	2	4							
rug										1	3	4	4	4	2	3	2	4							
wagon										1	4				4	4	3	4							
truck										4	3			3	2	3	1	4							
plant										4		1	1	1	3	4	2	4							
Time (sec.)										60	60	60	60	60	60	60	60	60							

D IV	Day 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
apple																			1	4	4				
horse																			2	4	4				
vase																			3	3	4				
mask																			2	3	4				
girl																			2	3	4				
Time (sec.)																			60	60	60				

D V	Day 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
flag																						4			
table																						4			
milk																						4			
bed																						4			
spoon																						4			
Time (sec.)																						60			

D VI	Day 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
house																							2	3	4
ring																							3	3	4
door																							3	4	4
witch																							4	2	4
glass																							3	4	4
Time (sec.)																							60	60	60

Subject: 3
Teacher: 2
Stimulus Condition: Visually and Auditorally Similar Words

A I	Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
snake		2	3	4	1	4	4	4	1	3	4															
lake		3	3	3	1	4	4	2	3	3	4															
rake		3	3	2	3	3	4	4	1	4	4															
bake		3	4	3	4	4	4	4	4	3	4															
cake		3	3	1	1	2	2	1	4	4	4															
Time (sec.)		60	60	60	60	60	60	60	60	60	60															

A II	Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
gate														4	3	4										
plate												3	3		1	4										
skate												3	3	3	4	4										
state													3	3	3	4										
date															1	4										
Time (sec.)												60	60	60	60	60										

A III	Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
sail																	1		3		4					
snail																	2	2	4	4	4					
pail																	3	3	4		4					
tail																	3	0	2	2	4					
nail																	3	3	4	4	4					
Time (sec.)																	60	60	60	60	60					

A IV	Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
chair																						4	0	3	3	4
hair																						3	3	3	3	4
fair																						3	2	3	4	4
pair																						4	3	4	2	4
stair																						3	4	3	3	4
Time (sec.)																										

Subject: 4
Teacher: 2
Stimulus Condition: Visually Similar Words

V I Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
boot	2				2	1		1		1	1		1	4		3	1	3	2		1	1	2	3	4
book	1	1	2			1		4			2		2	3	3	2	1	3	1	2	3	1	1	1	2
boat	1			1	1	1	1	1	2	1	1		1			3	1	2	2	1	2	1	2	4	3
boil	1					1			3	1	2	1	2			2	2	2	2	2	2	3	2	4	4
bowl	1		2	1		1	1			1	1	1	1	4	4	2	2	2	2	1	3	2	1	1	0
Time (sec.)	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60

Subject: 4
Teacher: 2
Stimulus Condition: Visually and Auditorally Dissimilar Words

D I	Day 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
grape	1		2	1	4																				
web	1	1	4	2	4																				
flower	3		2	2	4																				
sing	3		2	3	4																				
lion		1	2	2	4																				
Time (sec.)	60	60	60	60	60																				

D II	Day 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
leg						1	2	4	3	3	4					3	3	1	3	3	4	4	4	4	4
chicken						1		2	1	1	1	4	4	3	2	3	3	1	3	3	4	1	4	2	3
corn							2	3	2	4	4	3	4	4	4	2	2	1	2	3	4	4	4	4	4
baby						1	3	2	4	2	2	3	3	4		3	3	0	2	3	0	1	1	3	3
train						1	1	1	3	3	3	1	1	4	3	1	1	1	2	2	3	3	3	1	2
Time (sec.)						60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60

Subject: 4
Teacher: 2
Stimulus Condition: Visually and Auditorally Similar Words

A I	Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
snake		1	1	1		2	1	2	2		3	1	1		3	3	3	3	2	1	2	2	2	2	2	4
lake		1	1		1	2	3	3	1		2	1	1	1	4	3	3	4	3	4	1	1	1	0	4	4
bake			1	3	2	1	1	1	4	4	2	4	4				2	2	3	1	4	4	4	4	2	3
cake		1	1		1	4	3	3	2	4	2	2	1	1	4		4	2	4	4	4	1	2	1	3	4
rake		1	1	2		1		1	1	2	2	2	2		3	3	3	1	4	4		1	0	0	4	3
Time (sec.)		60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60

Subject: 5
Teacher: 3
Stimulus Condition: Visually Similar Words

V I	Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
boot		0													3	2	3	4								
book		1	1	4	4	4	4	2	3	3	3	4	4	3	4	4	2	4								
boat		1	2	3		1	3	2	1	2	2	2	2			1	2	4								
bowl		1		3									2	2	3	3	2	4								
boil		2		3			2						3	2	4	4	3	4								
Time (sec.)		60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	58								

V II	Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
fork																			1	1	0	4	4	4		
foot																			2	0	1	1	0	4		
foil																			1	1	0	3	4	4		
fort																			0	0	1	1	0	4		
food																			1	0	3	4	3	4		
Time (sec.)																			58	60	60	60	60	60		

VIII Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
brush																								0	2
braid																								2	2
bread																								1	1
break																								1	2
brick																								1	0
Time (sec.)																								60	40

Subject: 5
Teacher: 3
Stimulus Condition: Visually and Auditorally Dissimilar Words

D I	Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
grape		2	2	1	3	4																				
flower		1	3	3	3	4																				
sing		3	2	4	2	4																				
web		4	2	2	4	4																				
lion		2		4	4	4																				
Time (sec.)		60	60	60	60	55																				

D II	Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
leg							3		2	3	4															
chicken							3	3	1	3	4															
corn							2	1	3	3	4															
baby							3	3	1	3	4															
train							2	1	2	3	4															
Time (sec.)							60	60	60	60	60															

D III	Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
tiger												3	2	3	4	4										
rug												4	2	3	4	4										
truck												2	2	2	4	4										
plant												2	3	2	3	4										
wagon												1	3	3	3	4										
Time (sec.)												60	60	60	60	58										

D IV	Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
vase																	4	4								
apple																	3	4								
horse																	4	4								
girl																	3	4								
mask																	3	4								
Time (sec.)																	60	57								

D V	Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
milk																			1	4						
spoon																			3	4						
flag																			4	4						
table																			2	4						
bed																			3	4						
Time (sec.)																			60	57						

D VI	Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
glass																					2	4				
witch																					4	4				
door																					3	4				
house																					4	4				
ring																					4	4				
Time (sec.)																					60	54				

D VIII Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
bell																						3	2	3	4
pipe																						2	4	3	4
fish																						1	1	4	4
tent																						2	3	4	4
elephant																						3	3	4	4
Time (sec.)																						60	60	60	59

Subject: 5
Teacher: 3
Stimulus Condition: Visually and Auditorally Similar Words

A I	Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
cake		3	4	4	4																					
bake		1	3	2	4																					
lake					4																					
snake		3	4	4	4																					
rake		2	4	3	4																					
Time (sec.)		60	60	60	57																					

A II	Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
date						2	2	3	2	3	4															
gate						1	3	1	2	4	4															
plate						2	4	1	4	4	4															
state						1	3	2	3	3	4															
skate						1	3	3	4	2	4															
Time (sec.)						60	60	60	60	60	58															

A III	Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
sail												2	2		3	2	4	3	4							
tail												4	3	2	3	3	4	4	4							
nail												4	4	2	2	3	3	3	4							
snail														1	1	3	3	3	4							
pail												4	4	2	2	2	4	4	4							
Time (sec.)												60	60	60	60	60	60	60	50							

A IV	Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
chair																				0	1	4	4	4		
pair																				1	1	4	4	4		
fair																				2	2	2	2	4		
stair																				4	4	2	2	4		
hair																				4	3	2	4	4		
Time (sec.)																				60	60	60	60	58		

A V	Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
town																									2	2
gown																									2	4
frown																									1	2
clown																									1	1
crown																									0	2
Time (sec.)																									60	60

Subject: 6
Teacher: 3
Stimulus Condition: Visually Similar Words

V I	Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
boot		0	2	1	0	1	2	4																		
book		2	2	3	3	4	4	4																		
boat		0	0	3	1	0	3	4																		
boil		3	0	2	2	4	1	4																		
bowl		0	0	2	2	3	2	4																		
Time (sec.)		60	60	60	60	60	60	57																		

V II	Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
fort									0	0	2	3	1	1	4											
food									0	0	0	0	0	3	4											
foil									0	0	0	3	3	1	4											
foot									0	0	1	2	3	1	4											
fork									0	0	1	1	0	3	4											
Time (sec.)									60	60	60	60	60	60	57											

V III	Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
bread																0	0	0	0	1	3	2	1	3	3	0
brush																1	0	1	0	3	3	2	2	3	3	0
braid																0	1	0	0	0	0	2	3	1	2	0
brick																2	1	2	3	0	4	2	2	2	3	0
break																0	0	0	0	0	0	2	3	2	2	2
Time (sec.)																60	60	60	60	60	60	60	60	60	60	60

Subject: 6
Teacher: 3
Stimulus Condition: Visually and Auditorally Dissimilar Words

D I	Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
flower		3	4	4																						
web		3	2	4																						
sing		3	3	4																						
grape			1	4																						
lion		3	4	4																						
Time (sec.)		60	60	60																						

D II	Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
leg					4	4																				
chicken					4	4																				
baby					4	4																				
train					4	4																				
corn					4	4																				
Time (sec.)					55	47																				

D III	Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
tiger							3	0	0	4																
truck							3	1	0	4																
rug							3	3	4	4																
plant							2	3	4	4																
wagon							4	0	4	4																
Time (sec.)							60	60	58	53																

D IV	Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
apple											0	4														
mask											2	4														
vase											2	4														
horse											3	4														
girl											3	4														
Time (sec.)											60	50														

D V	Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
milk													4	4												
spoon													4	4												
flag													4	4												
table													4	4												
bed													4	4												
Time (sec.)													54	46												

D VI	Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
door																4										
glass																4										
witch																4										
ring																4										
house																4										
Time (sec.)																46										

D VII	Day 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
bell																4									
fish																4									
pipe																4									
elephant																4									
tent																4									
Time (sec.)																60									

D VIII	Day 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
tree																	3	4							
cow																	3	4							
pig																	4	4							
pot																	3	4							
pen																	3	4							
Time (sec.)																	60	44							

D IX	Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
star																				0	4	4	1	1	3	4
sock																				0	3	4	1	1	3	4
shoe																				2	3	3	3	4	4	4
bee																				2	3	2	2	4	4	4
bike																				2	2	1	1	1	3	4
Time (sec.)																				60	60	60	60	60	60	58

Subject: 6
Teacher: 3
Stimulus Condition: Visually and Auditorally Similar

A I	Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
cake		3	4	4	3	4																				
lake		3	2	0	3	4																				
bake		1	0	3	3	4																				
snake		4	4	4	4	4																				
rake		1	0	4	0	4																				
Time (sec.)		60	60	60	60	55																				

A II	Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
plate							0	2	3	2	2	4	3	4												
state							2	0	0	1	0	1	4	4												
skate							1	0	2	2	2	2	4	4												
date							2	1	0	2	2	4	3	4												
gate							1	3	2	3	1	3	4	4												
Time (sec.)							60	60	60	60	60	60	60	57												

A III	Day 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
sail														1	4										
snail														1	4										
pail														0	4										
nail														2	4										
tail														1	4										
Time (sec.)														60	58										

A IV	Day 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
stair																0	2	4							
fair																0	3	4							
chair																0	3	4							
pair																0	1	4							
hair																0	4	4							
Time (sec.)																60	60	57							

A V	Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
gown																				3	4	4				
town																				3	3	4				
down																				0	2	4				
frown																				4	3	4				
crown																				2	4	4				
Time (sec.)																				60	60	47				

A VI	Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
rock																							3	3	4	4
block																							2	3	3	4
sock																							1	2	3	4
clock																							2	1	2	4
lock																							1	1	2	4
Time (sec.)																							60	60	60	46

BIOGRAPHICAL SKETCH

Though I was born in Kinston, North Carolina, on March 23, 1952, I have spent the past 23 years in Gainesville, Florida. I graduated from P. K. Yonge Laboratory School in June, 1970, and entered the University of Florida a few weeks later. In the fall of 1971, I transferred to Valdosta State College, but returned to the University of Florida in 1972, where I received a Bachelor of Arts degree with honors in December, 1974. My major area of study was Communication Sciences and my minor was Speech Pathology.

In 1975, I entered graduate school in the Department of Speech to continue my studies in Communication Sciences. In the fall of that year I became intrigued with the field of learning disabilities and transferred to the Department of Special Education.

During my freshman year of college I was employed in the Department of Biochemistry at the University of Florida, in the laboratory of Dr. Waldo Fisher. From 1972 to 1977, I was employed in the same department, in the laboratory of Dr. Tom O'Brien. During the summer of 1977, I worked as a graduate assistant for a grant awarded to Dr. Stuart Schwartz of the Special Education Department. After completing my assignments for this project, I was employed by Gainesville Academy, a private school for exceptional children in Micanopy, Florida, as a teacher. I was promoted to principal of this school in January, 1978. One year later I again became involved with another grant project awarded to Dr. Schwartz. I was hired as the project coordinator for the grant entitled, Evaluation of the Vocational Preparation and Success of Handicapped Individuals Who Reside in Rural Areas of Florida. My part of the project will be completed by August, 1979.

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Cecil D. Mercer

Cecil D. Mercer, Chairman
Associate Professor of
Special Education

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Robert F. Algozzine

Robert F. Algozzine
Associate Professor of
Special Education

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Paul Jensen

Paul J. Jensen
Professor of Speech

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Stuart E. Schwartz

Stuart E. Schwartz
Assistant Professor of
Special Education

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Wm D. Wolking

William D. Wolking
Professor of Special Education

This dissertation was submitted to the Graduate Faculty of the Department of Special Education of the College of Education and to the Graduate Council, and was accepted as partial fulfillment of the requirements for the degree of Doctor of Philosophy.

June, 1979

Dean, Graduate School